AVIATION WEEK

MARCH 21, 1955

50 CENTS

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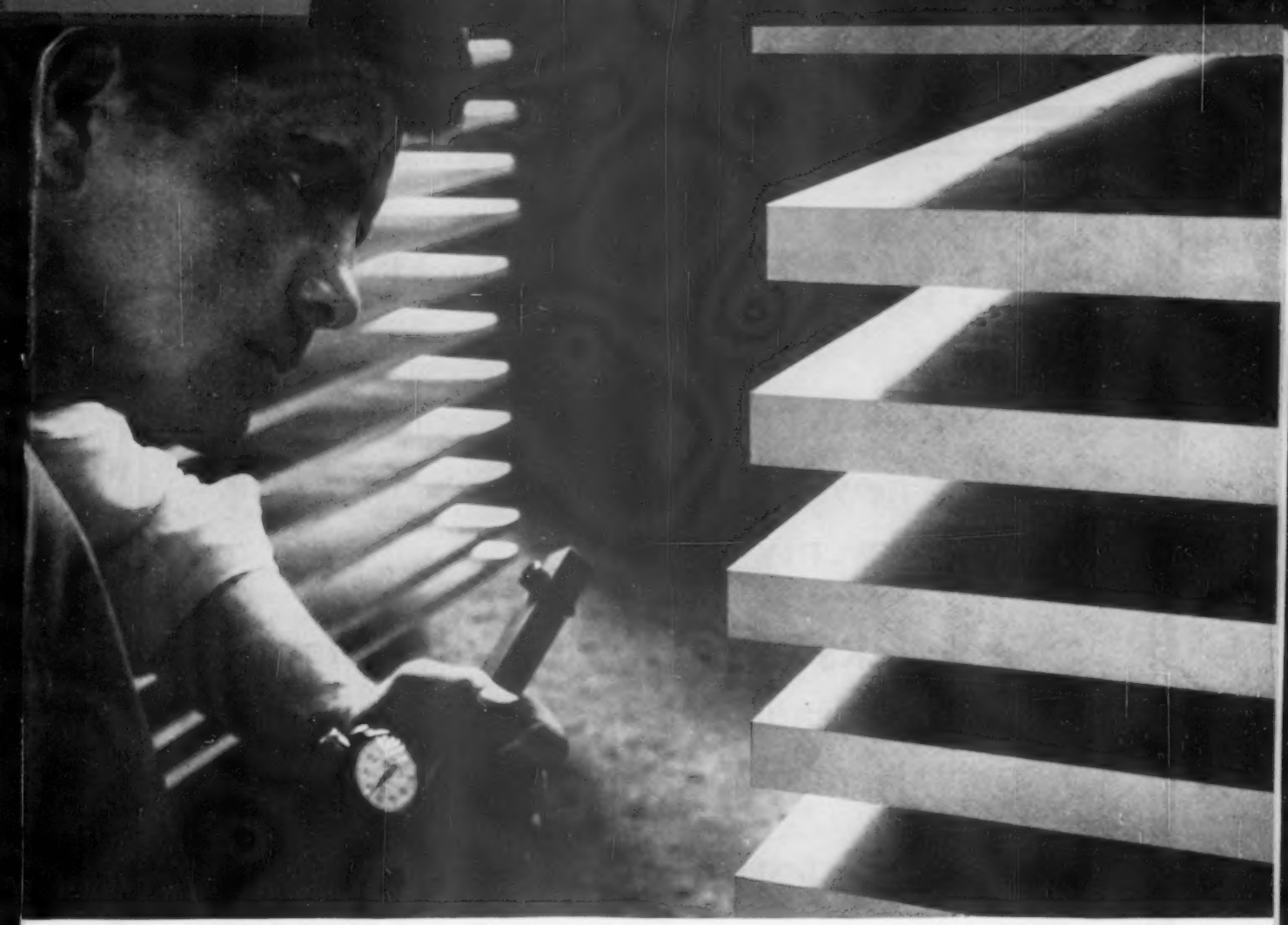

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NEWS DIGEST

Supersonic Super Mystere Starts Test Program

Dassault's new fighter prototype Mystere IV-B.1—named the Super Mystere—passed the speed of sound in level flight on its fourth test hop, made the day after its first takeoff Mar. 2. This new French fighter is the first of a series now entering production at the factories of Avions Marcel Dassault. Prototype is powered by British Rolls-Royce R.A.7R Avon, rated at 9,500 lb. thrust with afterburner; B.2 production models will have the French Snecma Atar 101G turbojet incorporating an afterburner.

Domestic

Labor dispute between five airlines and the International Association of Machinists (AFL) was settled last week after nearly a year's negotiation. The new contract was signed by United, National, Trans World, Northwest and Capital Airlines. Eastern Air Lines, also involved in the dispute, refused to ratify the pact. The agreement covers about 14,000 employes until Oct. 1, 1956, and involves wage increases ranging from 5 to 7 cents an hour—or a combined total of $2,597,000 annually.

Radically new aircraft projectile, developed to ventilate and ignite self-sealing fuel tanks, is in production for Navy's Bureau of Ordnance at Armstrong Cork Co., Lancaster, Pa., developers of the weapon. Shell is hollow and rotates at 300,000 rpm. to punch hole in tank and ignite contents. Named "Cookie-Cutter" by the Navy, it also will be delivered to Army under a production contract with Harvey Manufacturing Co.

Nuclear-powered aircraft design studies will be made by Curtiss-Wright Corp., Wood-Ridge, N. J., under a USAF contract.

One-man amphibious copter proposals, controlled by the "vector system" and lifted by rotors beneath a stand-on platform, have been submitted to the Navy, De Lackner Helicopters, Inc., Mt. Vernon, N. Y., has made 163 flights with its DH-4 Heli-Vector. An unidentified company has submitted a second proposal.

Sigmund Janas, Sr., former president of Colonial Airlines, was fined $22,000 by U.S. District Court in New York for falsifying the carrier's records while he headed it from 1938 to June 1951. Colonial, charged with carrying passengers at an unlawful rate, received a suspended sentence.

F-100A flight simulators, the first built for a supersonic aircraft, are being produced by Westinghouse Air Brake Co.'s Union Switch & Signal Division at Swissvale, Pa. The simulator was designed by Melpar, Inc., a wholly owned subsidiary.

Lt. Gen. Harold I. George has been recalled to active duty as a consultant to USAF Chief of Staff Gen. Nathan F. Twining. Former Air Transport Command chief, George's "indefinite period" at the Pentagon will not be devoted to airlift problems.

Brig. Gen. Edgar E. Glenn, 58, USAF representative at the Korean truce talks, former commander of the 1st Air Reserve Center at Austin and onetime chief of staff of the 14th Air Force under Maj. Gen. Claire Chennault, died Mar. 10 in San Antonio, Texas.

Financial

United Aircraft Corp., East Hartford, Conn., will ask stockholders at the Apr. 26 meeting to approve an increase in common shares from 4.5 million to 7.5 million, each with a par value of $5. UAC also will propose authorization of 500,000 shares at a par value of $100 each. The new issues would provide flexible capital structure and obtain funds for redemption of UAC's present 5% cumulative preferred stock.

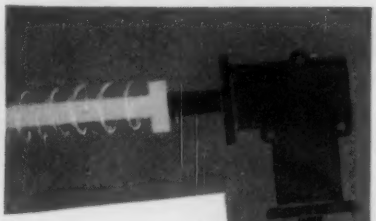
United Air Lines reports net earnings of $9,617,694 for 1954, a 6% gain over the previous year's $9,072,382 and second only to 1952's record $10,683,820. Operating revenues totaled $200,719,000, topping $200 million for the first time and climbing 16% from 1953. Operating expenses were $178,832,242, also 16% higher than last year.

Trans-Canada Air Lines had a net income of $496,146 in 1954, its fourth straight year of profitable operation. Net for 1953 was $256,230. Operating revenues totaled $68,764,252, compared with $62,236,564 the previous year. Operating expenses amounted to $67,731,512, increasing from $61,433,700.

International

Bristol Britannia Mk. 100 set a new civil record between London and Johannesburg last week, bettering the mark set by a de Havilland Comet 1. The turboprop Britannia made the 6,070-mile flight in 18 hr. 52 min. with one stop. Although faster, the jet Comet's shorter range forced it to make several stops and cut time to 21 hr. 50 min. The Mk. 100 will start flight tests in Africa under tropical conditions.

Sugg Solar, Ltd., has been formed in Britain by Solar Aircraft Co. and William Sugg & Co., Ltd., to market the U.S. firm's 60-hp. Mars turbine.



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R-330 3-way	1	1800	1500	2¼ lb

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The Aviation Week

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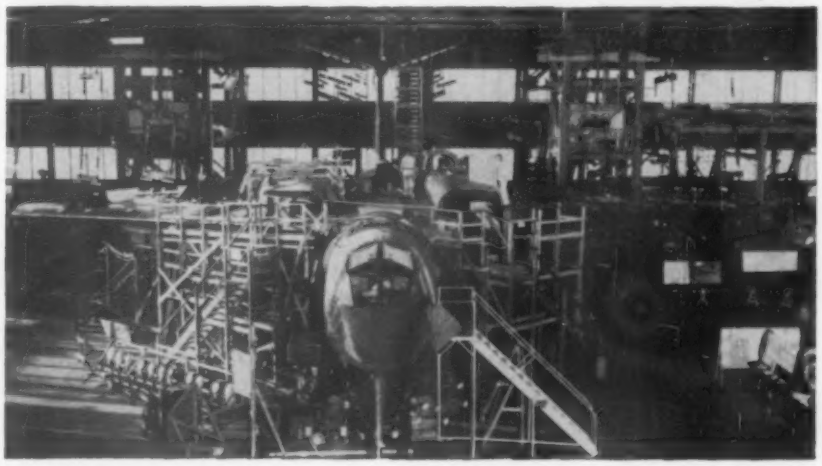
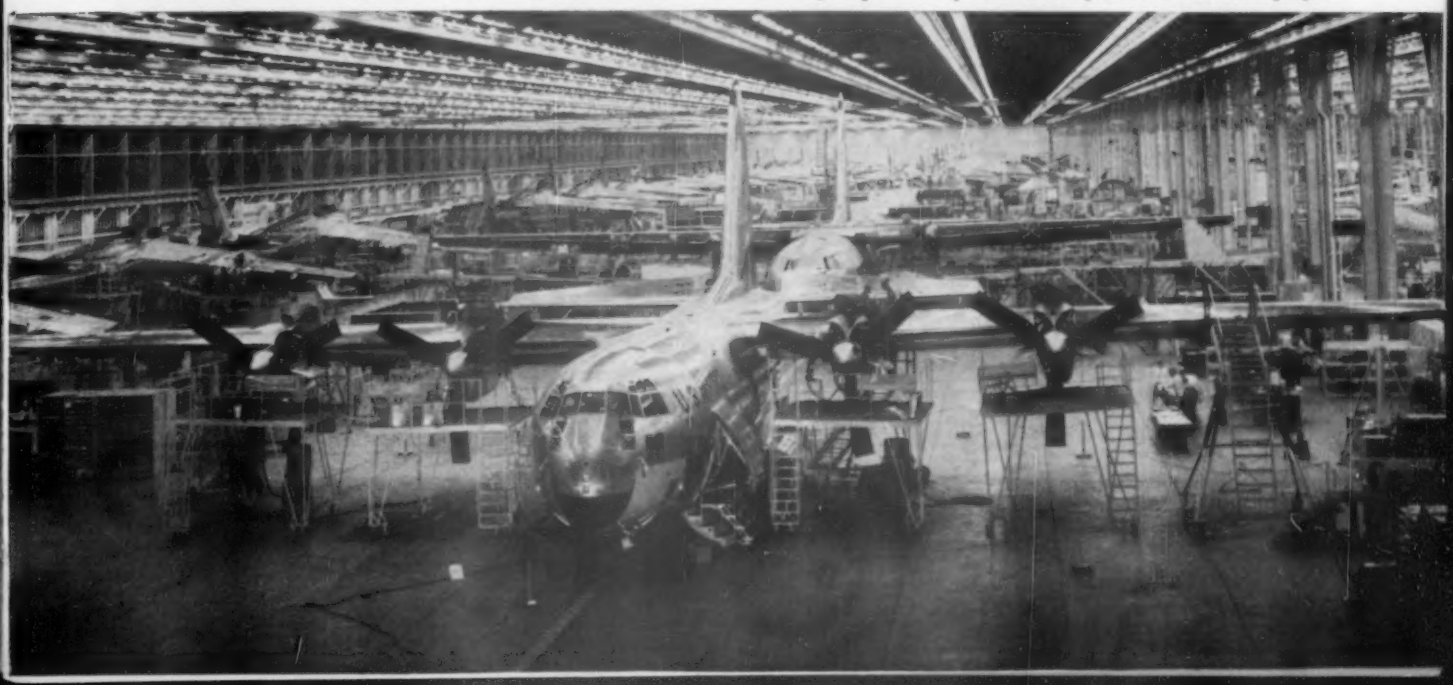
GRUMMAN S2F-1 sub hunter-killer shows its electronic gear in operational positions. A Magnetic Airborne Detection boom extends from the tailcone and a Goodyear spun-glass radome, with flow stabilizers to reduce turbulence, is under fuselage. MAD-boom detects and homes on submarines; the radar spots and tracks surfaced vessels. Sonobuoys are ejected from the engine nacelles.

New Hunters, Transport



MARTIN XP6M-1 SEAMASTER undergoes a strenuous workout inside its hangar at Baltimore, Md., to prove the integrity of the airframe under simulated highspeed flight conditions. Wings of the big four-jet flying boat have been subjected to applied loads of about 350,000 lb. First flight of the new plane is scheduled for this spring.

LOCKHEED C-130A HERCULES four-stage production line at Marietta, Ga., rolled out its first transport March 10. Photo is first view of C-130As in the plant. Hercules is a USAF medium combat transport powered by four 3,750-hp. Allison T56 turboprops.



INDUSTRY OBSERVER

► Northrop Aircraft's next model in the Scorpion series—the F-89H—is the first missile-carrying air defense weapon to become operational with the Air Force. Kill effectiveness has been increased substantially through the addition of the Hughes Falcon air-to-air missile (AW Feb. 28, p. 11). In effect, the F-89H is an F-89D with missile capability. The H-model is undergoing flight tests at Edwards AFB, Calif., in addition to the D-model with the H missile pod which is undergoing firing tests there. Plane is scheduled to be on the final assembly line about mid-April. One of the ships is a D being reworked into a H. Plans are being considered to increase the power of the H by switching to an afterburner version of another production jet engine. This version of the plane now is in the status of a proposal to the Air Force.

► Folland Midge lightweight fighter has completed 65 hr. of flight testing with 14 pilots. It is being fitted with a wing having technical features similar to those of the Gnat for renewed flight testing in April. First Gnat is due to fly with the Bristol Orpheus engine this summer.

► Cockpit canopies of Plexiglas and similar materials can now be made shatterproof through a Goodyear Aircraft Corp. development. Shatterproof property is obtained by stretching the material 100% in all directions, at the same time reducing thickness to one-fourth of the original dimension. Full-scale canopies of Plex 55 have been made by this process. Tests on General Aniline's Gafite have reached the half-scale stage thus far. Present aircraft canopies are made shatterproof through use of sandwich construction as in automobile safety glass. New Goodyear development permits use of a single piece of Plexiglas, needs no sandwich filler.

► Douglas-developed Skydrol-500, low temperature version of synthetic fire-resistant commercial hydraulic fluid, probably will fly first in Bristol Britannia for British Overseas Airways Corp. British carrier probably will carry over this application to the DC-7s it is scheduled to get. Fluid was developed about a year and half ago at the recommendation of USAF, and was found satisfactory but never used.

► Future versions planned for Lockheed F-104 include configurations for supersonic trainers as well as all-weather versions with capability of carrying two-man crew.

► Second production Bristol Britannia turboprop transport has made its first flight and joined the prototype and first production model in an intensive flight development program.

► Buffeting set up by the big retractable belly radome on the Grumman S2F submarine hunter-killer has been eliminated by installing raised ribs on the radome to break up the airflow (see picture, p. 9). Goodyear Aircraft Corp. makes the glass-plastic radome.

► Douglas F4D-1 Skyray, Navy interceptor, is scheduled to begin its carrier trials in about a month. Aircraft first flew in January, 1951, now is powered by a Pratt & Whitney Aircraft J57-P-2 engine.

► Snecma is developing a medium-thrust turbojet, smaller than the Atar. Static tests of its new engine were made a few months ago.

► Military observers have been impressed with the silencing job done by Convair with the help of an engineering group from Massachusetts Institute of Technology on a modified version of the Convair 340 transport. Among other features the new Model 340 has a squared nacelle. It will gross 1,000 lb. more than current versions and add 15 mph. to cruising speed in addition to the silencing features. CAA certification tests are scheduled for June.

► Convair Division of General Dynamics Corp. has organized an atomic division to explore industrial applications of nuclear power near its Ft. Worth aircraft plant. The new atomic facility is separate from the work now being done at Ft. Worth on a nuclear-powered aircraft.

WHO'S WHERE

In the Front Office

Sir Harold Roxbee Cox has been appointed an independent council member of Britain's Air Registration Board.

Evert Van Beek has become president of Trading Company Avio-Diepen N.V., Ryswijk, The Netherlands, replacing **Gysbert C. Snyders,** who resigned.

Robert W. Stoddard has moved up to president of Wyman-Gordon Co., Worcester, Mass., succeeding **Harry G. Stoddard,** new chairman of the board.

F. J. Mullins has been elected vice president and general manager of American Airlines de Mexico, wholly owned subsidiary of American Airlines. He succeeds **George C. Van Nostrand,** who has become vice president-properties and community affairs of the parent company.

Harold R. Larsen, vice president of Servomechanisms, Inc., Garden City, N. Y., has taken over the firm's Eastern and Western Division as general manager.

Changes

Walter H. Barling, designer and builder of the first U. S. heavy bomber and president of the prewar Barling Aircraft, Inc., has retired from Convair as superintendent of inspection at the Ft. Worth plant.

Guy W. Shafer has been appointed general manager of General Electric Co.'s small aircraft engine department at Lynn, Mass.

Daniel G. Russ, former senior project engineer for Bendix Aviation Corp.'s Products Division, has joined CDC Control Services, Inc., Hatboro, Pa., as general manager of the new Aviation Division.

Raymond C. Blaylock, chief engineer of Chance Vought Aircraft, Inc., has assumed responsibility for the Dallas company's engineering operations.

Parke W. Moewe, chief of Air Materiel Command's airlines unit at Wright-Patterson AFB during the Korean war, has become general counsel for Pacific Airmotive Corp., Burbank, Calif.

Paul Y. Davoud has joined Orenda Engines, Ltd., Malton, Ontario, as sales manager.

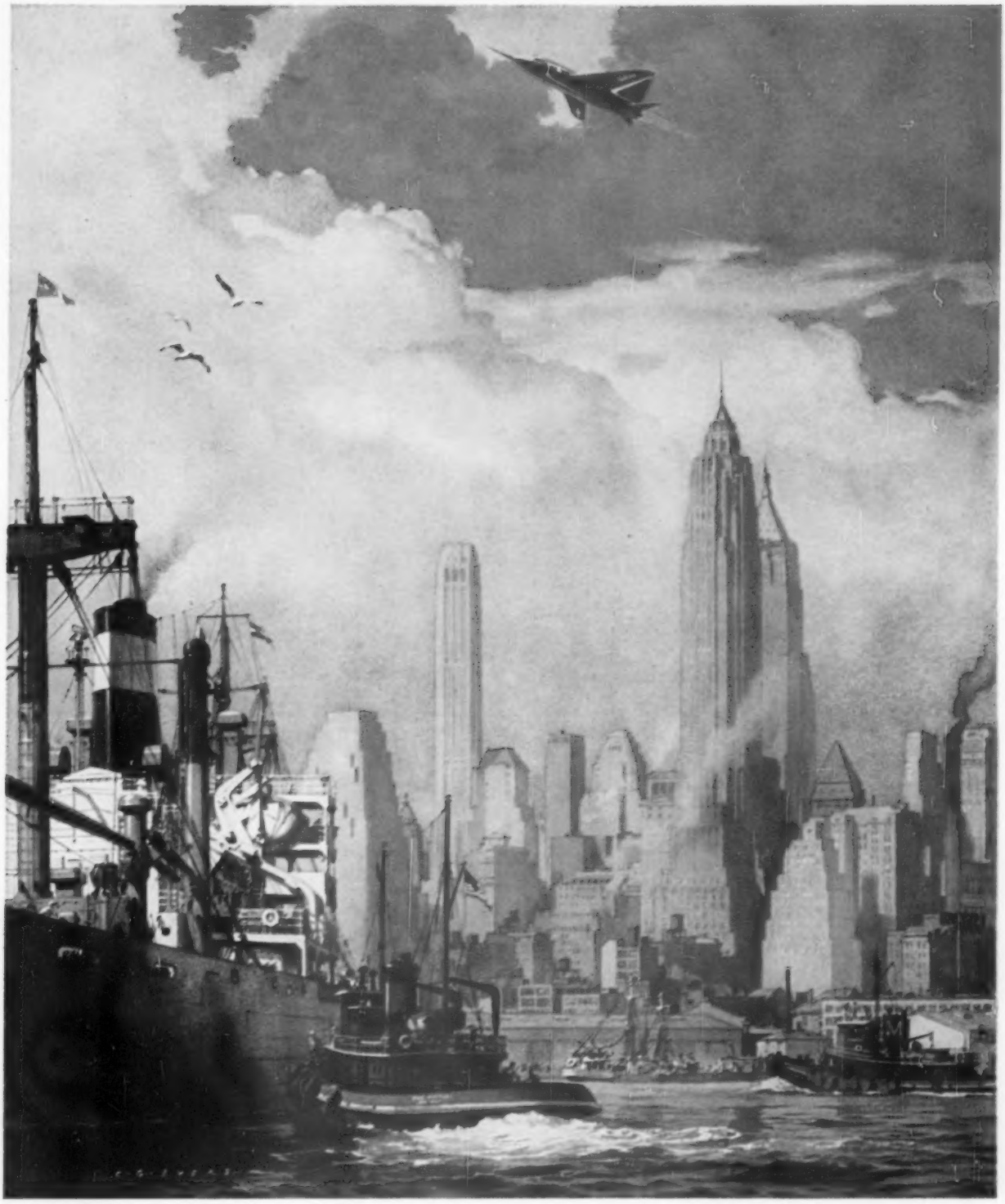
Max I. Black has been appointed sales manager of Royal Aircraft Corp., Milwaukee, subsidiary of Kearney & Trecker Corp.

A. M. Davis, former chief production engineer for A. V. Roe Canada, Ltd., has joined Marquardt Aircraft Co.'s Powerplants Division, Van Nuys, Calif., as chief engineer-powerplants.

Honors and Elections

Dr. Louis G. Dunn, associate director of Ramo-Wooldridge Corp.'s Guided Missile Division, has won an Army Certificate of Appreciation for development work including "conversion of a research test missile into the Corporal guided missile system."

Curt G. Talbot, manager of General Electric Co.'s Flight Test Center at Schenectady, N. Y., has been appointed technical committee chairman of the National Business Aircraft Assn.



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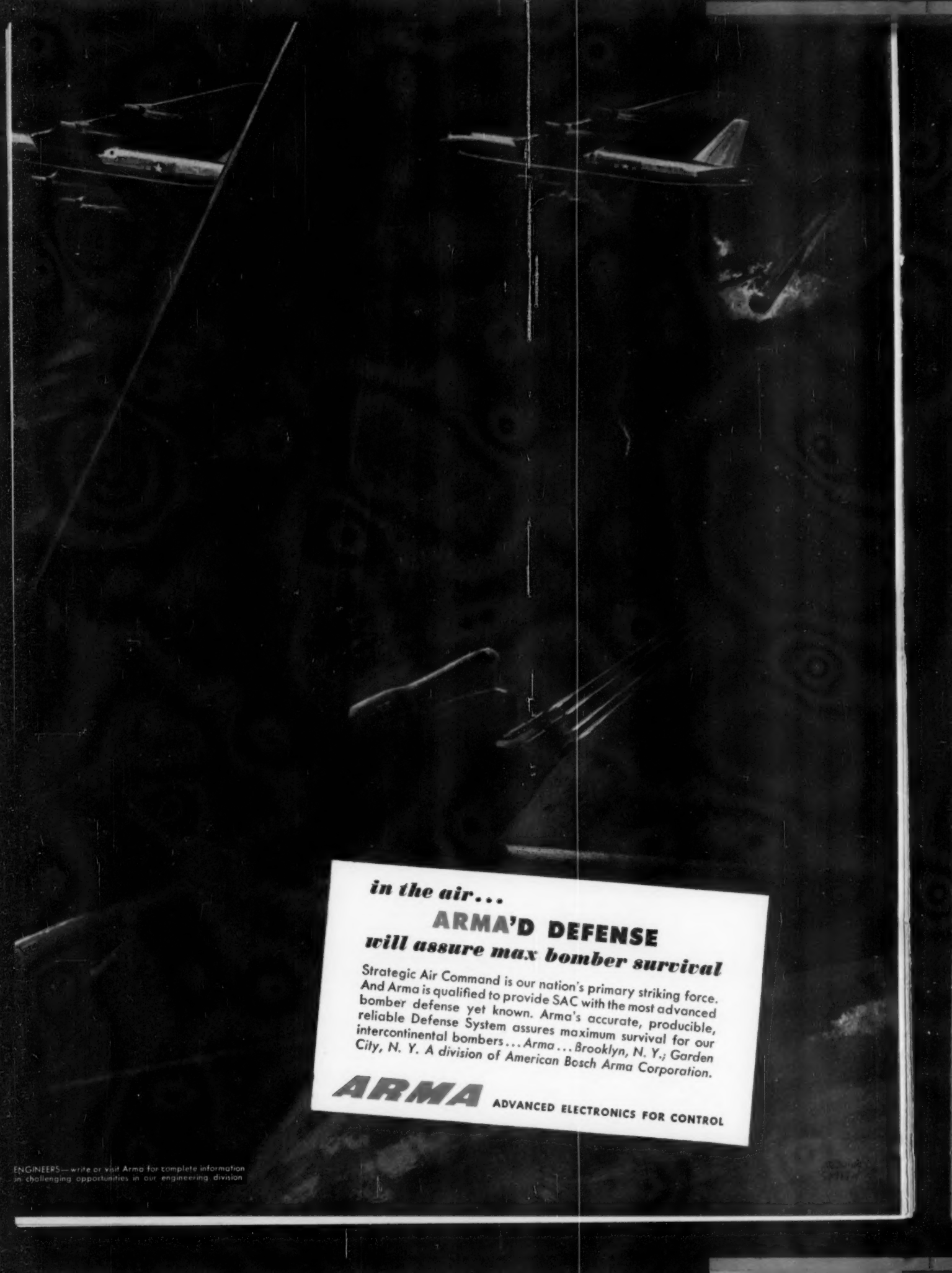

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Washington Roundup

ARDC Shift to Dayton?

USAF Secretary Harold Talbott is making no secret of his preference to move ARDC headquarters from its present quarters in downtown Baltimore, Md., to Wright-Patterson AFB at Dayton, Ohio, near Air Materiel Command headquarters. Special USAF committee is now studying relocation of ARDC headquarters, with Cambridge, Mass., and Andrews AFB, Md., (where ARDC was originally scheduled to move) also under consideration. Pentagon insiders are betting that Talbott's choice of Dayton will prevail. Observers who have followed the long and bitter ARDC-AMC battle believe the Talbott-sponsored move to Dayton could easily be the first step in subordinating the research and development effort to AMC control.

Federal Airport Program

Congressional consideration of the $11-million Fiscal 1956 federal airport aid program is expected to involve the following major points:

• **Size of the program.** The $11-million program is only a token program, actually will accomplish little, since a single new airport for the Washington area would require $25 million alone. Congressional pressure is expected to increase the size of the program since it involves local spending.

• **Two-year authorization.** Local authorities concerned with raising matching funds to augment federal aid are irked over the present year-to-year basis of the program and want it to shift to two-year authorizations similar to that used for public roads programming.

• **Inclusion of terminal buildings.** Present program excludes use of federal funds for terminal buildings and confines it to runways, lights, land, etc. Congressional feeling is that terminal buildings are legitimate part of airport operations and should be included in federal aid.

• **Scope of program.** There will be considerable discussion of whether the present standards for including airports in program are adequate to meet modern needs.

Lower Military Mail Rates?

Civil Aeronautics Board is seriously considering lower mail pay rates for international movements of military mail than for civilian mail. They have the same priority. Military mail moves in very large shipments and is concentrated in the high-density routes so that the cost of performing the service is presumably lower, Irving Roth, chief of CAB's Rates Division, explained to the House Appropriations Committee.

Pentagon Changes

New faces continue to join the Pentagon civilian secretariat, while the men whose resignations have been predicted continue in their jobs. Expected exits of Defense Secretary Charles E. Wilson and Army Secretary Robert Stevens have not developed and Wilson still insists there is no ground for the rumors.

Meanwhile, Robert T. Ross, former New York congressman, has been sworn in as Assistant Secretary of Defense for Legislative and Public Affairs, replacing Fred A. Seaton, who has been moved to the White House to give his counsel in more important circles. Seaton is spoken of as a top-ranking possibility to become new chairman of the Republican National Committee.

At a lower level and of more import to the aviation industry, was the appointment of Jerome D. Fenton, former assistant vice president in charge of industrial relations for Pan American World Airways, as director of the new Industrial Personnel Security Review Program of the Department of Defense. An attorney, Fenton will be in charge of the new central screening program set up by Wilson to speed clearances and reduce the number of cases forced into hearing.

Defense Cataloging

Completion of Defense Department's standard cataloging task of items bought by the armed forces is in sight. Big task has been under way since 1948, will reduce 4,500,000 items listed by the services to about 2,500,000. Examples: 800 types of screw drivers were cut to less than 100; 8,000 types of radio and electronic tubes were reduced to a standard 192.

Navigation Aid Snarl

Dispute over military Tacan or civil VOR/DME as the common civil-military system for short-range navigation has been clouded by excessive claims for DME investment and countercharges of inflated Tacan costs. (See p. 77.)

Total cost of VOR/DME may approach $500 million but more than 50% of this amount represents civil-military investment in VOR airborne equipment which will be used for another 10 years. The balance was expended on VOR ground installations, except for approximately $20 million spent by CAA for 215 DME ground units and private purchases of 80 airborne DMEs.

ANDB's decision to push development of Tacan for eventual adoption as the common system with a 10-year phase-out of VOR was intended to get full value from VOR. The immediate sacrifice of distance information by putting DME in mothballs was considered by ANDB "the cheapest price to pay in order to get the common system back on the track."

Carrier: Low Vulnerability?

Opposition to carrier aviation has been generated "outside the Department of Defense" and "has been carried on without the aid, assistance, or support of the military departments concerned," House Armed Services Committee declares. Its report also points out:

• A carrier task force which can be spread out over an area of 31,000 sq. mi., approximately the size of Indiana, "obviously . . . does not present a profitable target to an enemy, regardless of the type of bomb he may be using. This is further emphasized by the fact that the task force is always moving and thereby can avoid most secondary effects of thermonuclear weapons."

• In the troubled waters around Formosa where "our fixed airbases are . . . limited," the importance of having our carrier forces move into the threatened area to reinforce national policy "was readily apparent to all."

• Although Russia has upwards of 3,000 naval aircraft, there is no information concerning their having or building carriers. "We should continue to exploit this weakness of the Soviet Navy by continued development of our own aircraft carrier force," the report states.

—Washington staff

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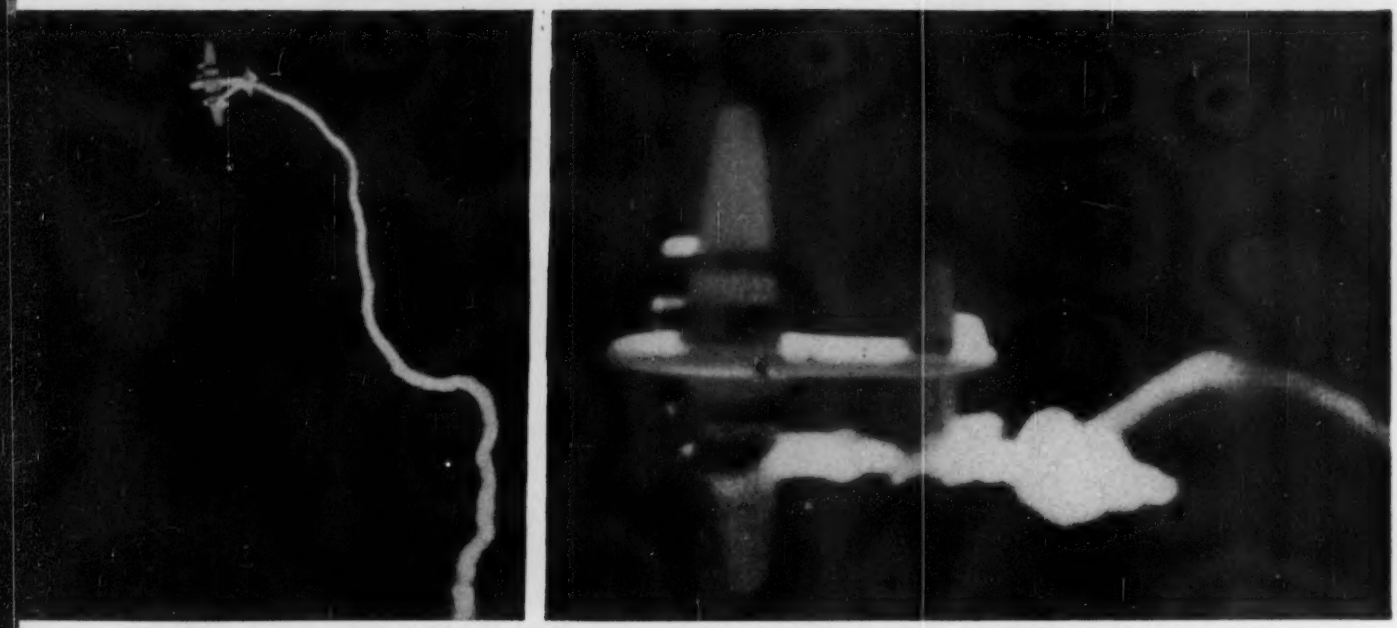


FALCON TRACKS, strikes drone Boeing B-17s in demonstration of its effectiveness of the USAF's newest air-to-air missile.

Operational Missiles Now Arming USAF

Scientific achievements spur program of Atlas IBM; Falcon proves successful as a defensive weapon.

By Robert Hotz

Guided missiles program of the U. S. Air Force has reached a successful development stage and is making progress toward the production of operational missiles for both offensive and defensive use as a result of major scientific achievements by the aircraft industry and its research support.

These developments are:

• **Packaging atomic and hydrogen** warheads. Development of small, lightweight atomic warheads with high destructive yields equivalent to early bulky bombs has been a major revolution for the missile business. Now similar reductions in the weight and size of hydrogen weapons promise to simplify both guidance and propulsion problems for intercontinental missiles. For every pound of weight reduction in the missile warhead approximately 100 lb. of fuel can be saved on an intercontinental missile. The use of a hydrogen warhead with its widespread power of destruction also relaxes the earlier accuracy requirements for precise missile guidance to the target.

• **Re-entry problem.** Although details of this must necessarily remain masked by military security the most difficult part of this problem for ballistic-type missiles has been surmounted and promising solutions are in sight. The problem was that the ballistic missile on re-entering the earth's atmosphere at hypersonic speeds generates sufficient heat from skin friction to melt the warhead. Even German V-2s travelling at only 3,000 mph., encountered this problem during World War II.

• **Guidance.** Major developments in celestial guidance equipment have made this method feasible for long range guidance of intercontinental missiles.

• **Powerplant.** Recent progress in both rocket and ramjet powerplants now make it possible to drive huge missiles at the hypersonic speeds required for long range operations.

Promising USAF missile projects include:

Atlas

The Atlas SM-65 intercontinental ballistics missile (AW Mar. 7, p. 12) is now well under way as one of the most important development programs ever tackled by USAF and the aircraft industry. Its goal is to explode a hydrogen bomb warhead on enemy targets 5,000 mi. from the launching point. Atlas will benefit enormously from the recent significant reductions in the size and weight of hydrogen bomb packages. Slash in gross weight of perhaps more than half the original 500,000 lb. planned should be possible.

Atlas will be propelled by two sets of liquid-fueled rocket motors in a two-stage operation. One set of motors and fuel tanks will be detached from the missile after providing the power to break out of the atmosphere into space, leaving the second set of motors to propel the warhead and guidance system to the burn-out point from which the coasting ascent to peak altitude begins.

Trajectory calculations for a 5,000-mi. IBM missile show a required speed at burnout of about 22,000 ft. per sec. Burning time would be about 12 min., during which the rocket would climb out of the atmosphere and turn to an angle of about 26 deg. with the horizon. It would then coast to a peak altitude near 800 mi. before plunging, tail down at first, toward the target. Total flight time would be about half an hour.

Currently the Atlas program involves the following contractors:

• **Convair Division of General Dynamics Corp.** Convair has been involved in ballistics missile research for eight years and was originally scheduled to be the prime weapons system contractor for Atlas. Now it appears that Convair will make the Atlas shell, fuel

tanks and possibly the warhead as well.

• **North American Aviation Inc.** This firm will make the 120,000 lb. thrust liquid-fueled rockets that will be used in the first stage of Atlas propulsion. North American may also build the second stage rocket motors, but Bell Aircraft Corp. and Aerojet-General Corp. are also competitors for this production job.

• **General Electric Co.** Guidance system for the Atlas will be developed and built by GE.

• **Ramo-Wooldridge.** This firm currently has a $9 million contract for evaluating various technical proposals in the Atlas program but also will probably get the contract to design and build the nose section which is critical in the problem of re-entering the atmosphere on the way to the target. Ramo-Wooldridge were also being considered as over-all managers of the Atlas project under the weapons system concept under supervision of Air Research and Development Command's Western Development Division.

Convair's position in the Atlas program will be strengthened by the addition of Dr. Frederic de Hoffmann, nuclear physicist and former deputy to Dr. Edward Teller at Los Alamos Scientific Atomic Laboratory and appointment of a scientific advisory group heavily loaded with atomic weapons experts.

▶ **USAF Criticism**—Convair's engineering effort on the Atlas project has been strongly criticised by USAF for lack of sufficient talent versed in nuclear weapons, highspeed aerodynamics, high-altitude physics and missile guidance problems. This criticism played an important role in diminishing Convair's original role as prime weapons system contractor for Atlas to one of several major contractors in the program. It also resulted in USAF bringing the Ramo-Wooldridge group into the Atlas project.

Among the top names on the new Convair advisory group are:

• **Dr. Theodore von Karman,** pioneer in supersonic aerodynamics.

• **Dr. Hans Bethe,** atomic and hydrogen bomb pioneer.

• **Dr. Edward Teller,** hydrogen bomb expert and associate director of the University of California Radiation and Livermore Laboratories.

One big stimulus to recent progress in the Atlas program has been a practical solution to the re-entry problem when the missile comes plunging back into the earth's atmosphere at speeds that produce heat from skin friction sufficient to melt the toughest materials. Although the precise method of Atlas re-entry is correctly still cloaked by military security, there are several generally known approaches to this problem. They are:

• **Slowdown.** By slowing the speed of the missile the skin friction is reduced tremendously. For example, a speed reduction of 50% will cut skin heating by 75%. One method considered to slow the missile is to break it up into several chunks on re-entry and allow the warhead to float down separately. With a hydrogen warhead, the accuracy lost by this operation would not be serious. Mechanical speed brakes could also be used, similar to dive brakes on an aircraft or drag chutes. These devices could tear off or melt during the descent but would still slow the missile to acceptable speeds.

• **Burnaway.** This method calls for utilizing successive layers of heat-resistant materials that will burn through during re-entry but keep the friction-generated skin heat away from the warhead until it is detonated.

• **High altitude explosion.** This method would explode the warhead above the atmosphere before the missile made its re-entry. With a hydrogen warhead this might be effective.

DEAD CENTER! Falcon blasts up through Boeing B-17 drone for direct hit.

HUNDRED-POUNDER Falcon is six feet long, can be handled easily by two technicians.

Falcon

First official details on the Hughes Aircraft Falcon (GAR-98) air-to-air missile were released by Trevor Gardner, USAF Assistant Secretary for Research and Development in a speech to the USAF Institute of Technology at Dayton. Gardner said the Falcon was "one of the most important contributions to the defense of the North American continent since the development of radar." He revealed that the Falcon is in production at Hughes Aircraft's Tucson,

Ariz., plant and will soon be installed operationally in USAF interceptors. (See p. 15).

The Falcon weighs "a little over 100 lb.," travels at supersonic speed and contains its own automatic guidance equipment that makes it home on an enemy target. It is 6 ft. long and 6 inches in diameter."

▶**'Hit Is a Kill'**—The Falcon has been successfully test fired from the ground and from the Convair F-102 delta wing interceptor in the air at QB-17 bombers and F-80 jet drones. The Falcon knocked down these flying targets at Holloman AFB, N. M., even without using an explosive warhead.

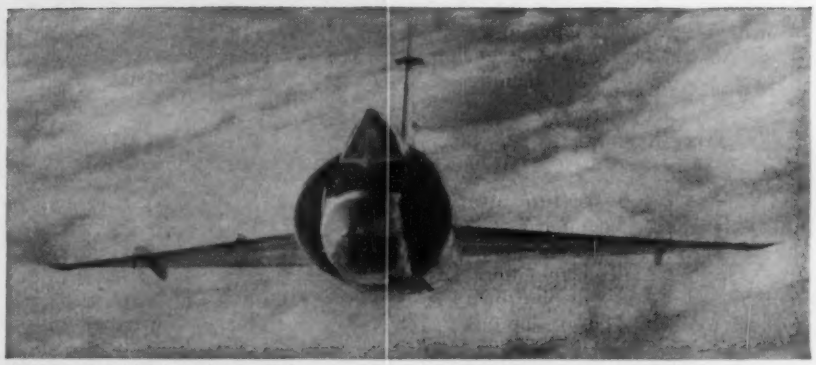
"Falcon tests using an explosive warhead show that virtually every hit is a kill," Gardner said.

Falcon is driven by a solid-propellant rocket that produces over 6,000 lb. thrust and puts a load of about 60 Gs on the missile at the time of launching. The fact that the Falcon avionic gear can withstand this shock and function successfully afterward indicates a major advance in rugged construction for this type equipment.

Howard Hughes, owner of Hughes Aircraft, said the Falcon tracking and homing avionic gear created unprecedented problems in design engineering and manufacturing.

"For example," he said, "the miniaturization of components was necessary to an extent to what would be required if you compressed two television sets into the size of a football."

▶**Advanced Versions**—The Convair F-102 and the Northrop F-89H will be the first operational aircraft to use the Falcon as a weapon in the air defense system of the North American continent.



CONVAIR F-102A will be a Falcon carrier, salvoing up to six of the missiles.

The F-102 can carry a load of six Falcons and fire them automatically in salvo when its radar and fire control system have located and locked onto an enemy target.

The Falcon can be fired while an interceptor is still climbing, thus saving valuable time for attack since the Falcon's rocket motor takes over the remainder of the climb to target at supersonic speeds. Range of the Falcon is several miles. Gardner said the Falcon and the avionic equipment of the interceptors that will launch it will provide air defense crews with a better chance of killing enemy bombers than they have ever had before.

Although neither Gardner nor Hughes mentioned them, industry observers report that several advanced versions of the Falcon are already under development at Hughes Aircraft in Culver City. Hughes has been working on the Falcon program since 1950. Originally it was a General Electric Co. project known as Dragonfly but was dropped by GE in the study phase and reinstated by USAF with Hughes for the 1954 all-weather interceptor competition that produced the F-102.

Snark

The Northrop Snark SM62 is the first long-range USAF missile to reach the flight test stage. It is now being flown at the Long Range Missile Test Center with launching at Cape Canaveral, Fla. Snark is a turbojet-powered pilotless aircraft aimed at 5,000-mi. range at high subsonic speed. It is now powered by an Allison J33 centrifugal turbojet, but later versions will use the Pratt & Whitney J57 axial turbojet. The early Snark, now in experimental flight test, is a tailless design with a long, narrow-chord wing swept back 45 deg. Constant chord control surfaces are used on wing and vertical tail. Wingspan is about 30 ft. with a fuselage length of about 32 ft. Vertical tail is swept to match the wings and is high with a narrow chord.

▶**Guidance**—Snark is launched from the Northrop rail-running highspeed rocket sled (AW Sept. 7, 1953, p. 26) or by zero-length launching with solid propellant rocket boosters.

After initial climb to cruising altitude it attains a cruising speed of Mach. 9 and navigates by a combination of celestial and inertial guidance. This is probably a star-tracking telescope supplying intelligence to a control system plus integral auto-pilot. The auto-pilot would establish the initial course and climb path, cut out during cruise and then cut back in again during turbulence (when the telescope would have trouble locking onto its selected star) or at times when clouds obscure the star being tracked.

The Snark will be equipped to carry a nuclear war-head. It was recently the subject of a top-level USAF discussion aimed at killing the program because of the missile's slow speed while penetrating enemy defenses. Snark is considered too easy a prey for anti-aircraft

Convair Advisors

Convair has recruited a team of scientific advisors to assist in the development of missile systems and aircraft, and to study problems of basic nuclear research. The scientists listed by their specialties, are:

• Theoretical Physics. Dr. Hans Bethe, professor of physics, Cornell University; Dr. Kenneth M. Case, associate professor of physics, University of Michigan; Dr. Charles L. Critchfield, professor of physics, University of Minnesota; Dr. Mark M. Mills, chief of theoretical physics division, University of California Livermore Laboratory; Dr. Edward Teller, professor of physics and associate director of Radiation and Livermore Laboratories, University of California; Dr. John A. Wheeler, professor of physics, Princeton University.

• Metallurgy and Theory of Metals. Dr. Robert F. Mehl, head of Department of Metallurgical Engineering and dean of Graduate Studies, Carnegie Institute of Technology; Dr. Frederick Seitz, professor of physics and scientific director of Control Systems Laboratory, University of Illinois.

• Experimental Physics and Electronics. Dr. Lan Jen Chu, professor of electrical engineering, Massachusetts Institute of Technology.

• Mathematics and Aerodynamics. Dr. Theodore von Karman, chairman of the Advisory Groups for Aeronautical Research and Development for NATO. Dr. Richard Courant, director of Institute for Mathematics and Mechanics, New York University; Dr. Peter D. Lax, associate professor of mathematics, New York University; Dr. Milton S. Plesset, professor of applied mechanics, California Institute of Technology.

• Astrophysics. Dr. Fred L. Whipple, chairman of Department of Astronomy, Harvard University.

missiles or enemy interceptors but the program is being continued with later development of the original Snark design.

Navaho

North American Aviation's Navaho SM-64 is a ramjet powered missile also aimed at 5,000 mi. intercontinental range and cruising at about Mach 2.5 at an altitude of 75,000 ft. Navaho's airframe has been flight tested using turbojet power at Edwards AFB, Calif., and the ramjets scheduled to power it also have flown in a special test vehicle registering successful performance up to Mach 3 and 90.000 ft. altitude. Navaho will use a celestial guidance system and is also designed for hydrogen bomb war heads.

Rascal

The Bell Rascal GAM-63 is very close to being an operational missile ready for use with the Strategic Air Command's fleet of B-47 and B-36 bombers. This air-to-surface missile packs an atomic warhead and is driven at about 1,000 mph. by a Bell three-barrel rocket engine after high altitude launching from the mother-bomber. The Rascal gets guidance from the mother plane during its target run. It has registered hits with amazing accuracy during simulated combat conditions and is in production at Bell's Niagara Falls, N. Y. plant.

Bomarc

This Boeing air defense missile is designed to extend far beyond the limited 15 mile Nike range to intercept enemy bomber up to 250 miles away from their intended targets. Bomarc IM-99 has been in considerable system development trouble although its components have good reliability. It is powered by a pair of Marquardt ramjets.

British Missile Details Revealed

Anti-aircraft types nearing production; hints dropped regarding IBM prospects; 1500 missiles tested.

Many new details of the British guided missile program have been revealed in a recent article by the scientific correspondent of the Financial Times, published in London. The following excerpts provide information on specific British missile projects and the scope of the program:

"Britain's guided missile program is by no means negligible. The White Paper on Defense states that production orders have so far been placed for one type of guided missile to be carried by fighter aircraft (fighters are already being equipped with special [Ekco] radar 'eyes' which calculate their distance from the target) which is guided to its target electronically. A number of such electronic homing devices have been developed, some of which depend on the use of photocells which are especially sensitive to the infra-red rays generated by the heat of the enemy plane. They can sense the presence of comparatively low heat sources and respond by triggering off a relay circuit which uses the power stored in a small electrical battery to operate the missile's navigational controls. Missiles of this type have been tested over a long period on a number of planes.

▶ **Near Production**—"More than 1,500 guided missiles have, however, been fired off at the rocket ranges at Woomera, Australia, and Aberporth, Wales, and a number of other guided missiles are nearing the production stage. One of these is the radar-controlled English Electric anti-aircraft guided missile which can be fired from the ground to heights exceeding 50,000 ft. and which can maneuver and travel towards its target at speeds exceeding 2,000 mph.

"A second British guided missile of a similar type which is also nearing production is the Armstrong Sperry Whitworth-Gyroscope Company Naval anti-aircraft rocket. This rocket was tested both at Woomera and, on a small scale, at sea off Aberporth in 1954. It has four sets of twin booster rockets to start it on its way.

"This rocket is one of several which will be used on the special guided missile ships described in the Naval Estimates.

▶ **Sense Sound**—"Such prey-seeking devices, of which a number of different types are under investigation, can be designed so as to seek out not only heat (that is, infra-red rays) but also magnetic radiations from the enemy's fuselage or electronic equipment, or electrostatic discharges such as those caused by the enemy plane's or missile's passage through the air. British devices have been developed that will sense and locate sound, estimating its distance and direction, while other devices, which are likewise capable of operating the navigational controls of missiles via amplifying and relay circuits, can detect the wake of planes or missiles.

"Miniature short-range radio sets like the Ekco radar eye already mentioned, though far smaller, can also be used to direct this final homing of the missile to the bomber it must destroy. Lilliputian capacitors, wires, batteries and other components have had to be produced so that such devices, some of which contain ten times as many valves [tubes] as a large television set, can be fitted into the missile.

"Some of Britain's guided missiles, like one V-2 type two-stage rocket, have a single booster unit which is clamped on to the rear of the liquid-fueled rocket proper during take-off. Others are ramjets, but which after being initially accelerated to their cruising speed can travel at speeds from 1,200 mph. to 3,000 mph. for 100 miles or more.

▶ **Rocket Progress**—"Fairey Aviation is developing guided rockets which are nearing the production stage as well as experimental radio-controlled delta-shaped craft resembling ordinary planes which after being initially powered by solid fueled cordite rockets, can then cruise short distances at great speeds with the aid of their liquid hydrogen peroxide fueled Beta rocket motors.

"The short-range (20 miles or so) Naval artillery guided missiles whose development was forecast in the Naval Estimates and the long-range inter-continental rocket, capable of traveling 1,000 miles or more, forecast in the Defense White Paper, are primarily weapons intended for delivering nuclear explosives.

"Work is already well advanced on similar land-to-land bombardment rockets, some of which may, it is expected, achieve, if not exceed, the aims of the German wartime project A-10 and carry their missiles far above the earth's atmosphere, which ceases 100 miles up.

▶ **Revolution in Materials**—"Behind all this development work in which more than 100 British companies are engaged, lies a revolution in the development of new materials capable of withstanding the immense temperatures and stresses created and also a numerous range of novel control instruments (the American Nike has 1,500,000 parts) and a mass of aerodynamic research.

"There is also the new radar chain using a new and more efficient type of radar, which, with its hundreds of subterranean control units, now covers the whole of the United Kingdom. Linked to this chain a further network of electronic instantaneous response controls is being developed which, when fully perfected, will, it is hoped, automatically scan all objects traveling in the air. Then with the aid of centrally based computers it will identify them as friend or foe. In the latter case the computer will trip a switch which sets off action pulses which in turn will start the firing devices for those missiles closest to the target within a fraction of a second."

Navy Blames Engine Builders For Costly Production Delays

Over-optimism of engine manufacturers who misrepresent the time needed for development of new jet power units is blamed by U.S. Navy for setbacks and unreasonably high costs in its aircraft program.

In a hard-hitting speech, James H. Smith Jr., Assistant Secretary of the Navy for Air, told a propulsion meeting of the Institute of Aeronautical Sciences at Cleveland, Ohio, that the industry too often is guilty of using the "impossibly optimistic plan" to sell an engine proposal.

▶ **Examples of Delays**—Time estimates given to the Navy, Smith said, commonly do not allow for delays in development with the too-frequent result that aircraft scheduling is upset at a high cost in dollars and fleet effectiveness.

As a concrete example, Smith cited the cases of the Chance Vought F7U and McDonnell F3H aircraft cancelations of last fall. These were attributed by the Navy to development delays in the Westinghouse J40 and J46 and Allison J71 engine programs.

Smith said the Navy has an investment of over $1 billion in these programs, not counting government furnished equipment.

▶ **'Violent Readjustments'**—"We underestimated the (development) time by one-half and established our production schedules accordingly. Our scheduling would have been just about right if the engines had required only the estimated three years in development, but when they actually took twice that long the rest of our program had to go through violent readjustments," he said.

One outcome of the Navy's experience has been a statement by Defense Secretary Charles E. Wilson that there have been too many engine developments following this path. Defense Department's first suggestion for a remedy was a proposal that more standardization be introduced and fewer engines carried through to production.

Producer of this plan, which has brought strong objections from most of the industry and is known to lack favor in both the Navy and Air Force, was the office of Frank D. Newbury, Assistant Secretary of Defense for Applications Engineering. It was reportedly written by Floyd T. Hague, director of aircraft and marine craft under Newbury.

▶ **Cutlass Delays**—Both Newbury and Hague are former vice presidents of Westinghouse. The former heads a committee set up by Wilson to draft a new directive governing engine development. Smith is a member of the group, along with Roger Lewis, Assistant Secretary of the Air Force for Materiel.

None of the Defense Department critics, including Smith, Newbury and Wilson, have made any mention of the role played by Navy's Bureau of Aeronautics in engine procurement. Some industry observers, cognizant of BuAer's responsibility to monitor development programs, have felt for a long time that its experts are prone to accept exaggerated claims by certain manufacturers, turning down more conservative but realistic proposals.

So far, BuAer has been silent in the growing controversy over the jet engine situation.

Further details of the F7U Cutlass situation were outlined last week in Chance Vought's annual report. The F7U-3 version was the company's main production project in 1954.

"From the beginning," the report says, "the Cutlass program has been beset by delays and development problems of the engines which an engine manufacturer is furnishing for these airplanes." The power unit is the Westinghouse J46-WE-8, rated at 4,000 lb. thrust.

▶ **Problems in 1955**—"During the year 1954 it became apparent that the task of introducing a carrier-based fighter such as the Cutlass with the severe handicap of an unsatisfactory powerplant was beyond realization under the schedule ordered by the Navy. Accordingly, the program was reduced in January 1954, and two important schedule stretchouts were effected during the year.

"It is expected that the Cutlass and its engines will be subject to development problems throughout part of the year 1955," the report says, indicating that more time will be needed to smooth out the carrier-based fighter's production program.

On the subject of the cancellations, the report says they resulted in loss of orders for 96 Model A2U-1 aircraft, the attack version of the Cutlass.

▶ **Operations Reduced**—"The development and supply," the report states, "by an engine manufacturer of a new and improved engine model required for the Model A2U-1 airplane was unacceptably late and therefore the Navy found it necessary to cancel the engine program. No suitable alternate engines were available.

"The production program was originally scheduled for delivery during the years 1955 and 1956, and the level of operations for these years will be reduced somewhat by the cancelation."

(The reference here was to another Westinghouse engine, a later version of the J46.)

Smith pulled no punches in directing his indictment of the country's aircraft industry.

▶ **Tougher Policy**—"It seems as though," he said, "both the engine and aircraft contractors were content with the short-range view that a big contract in hand on which delivery is shaky is better than the chance of a really sound program at a later date.

"In plainer words, let's get a big contract backlog now and muddle through the production program later!"

Smith made it clear that the Navy's procurement policy is getting tougher on these matters, and a reputation for ability to deliver what is promised carries more weight than it has in the past.

"Industry shares with the government," Secretary Smith asserted, "a responsibility for the over-all safety of the country.

▶ **'Realistic Planning'**—"In exercising that responsibility it needs to show a more mature and restrained attitude in planning and designing new aircraft models if we are to achieve results.

"The restraint would come in the form of realistic planning and in the selling of future programs based on estimates on which the estimator realizes his reputation is at stake, not on a headlong urge to build up the backlog, come what may.

"As the engine and airframe development contracts generally call for payment of costs plus a fixed fee, the contractor is concerned but not financially worried about his mistakes," the Secretary charged.

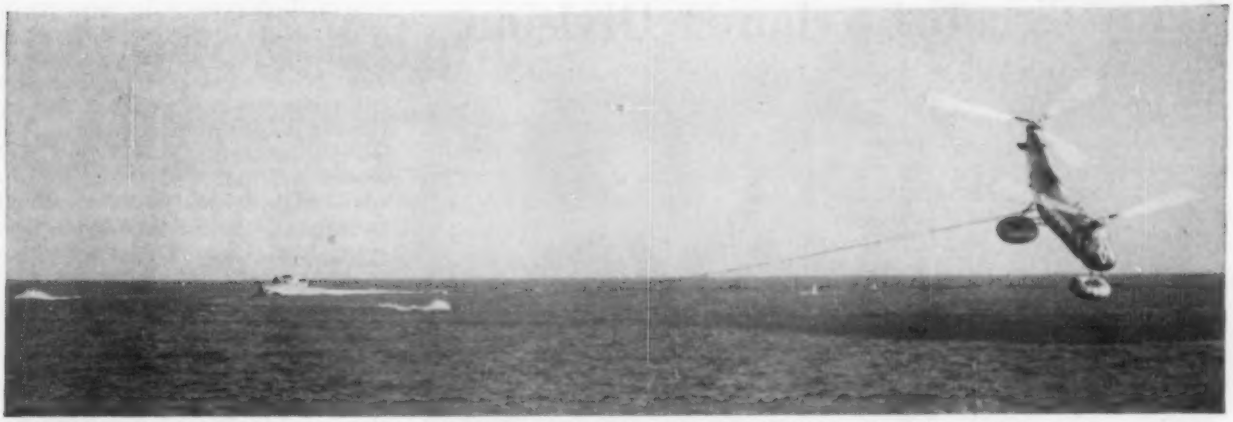
He then suggested that an indemnity clause in the contract might help restrain some contractors from promising what they cannot deliver.

'Rotorless Copter'

First flight of an "unconventional lifting device"—a type of "rotorless helicopter"—have taken place at the plant of Hiller Helicopters in Palo Alto, Calif.

Announcing the development in a speech at San Francisco, Stanley Hiller indicated his company has made advances in development of a vertical-rising fixed-wing plane, a "marriage" of rotary-wing and conventional aircraft.

"Don't be surprised," he said, "if you open your morning paper in the not too far distant future to read of the establishment by one of the largest aircraft manufacturers of an anti-gravitational division."



PIASECKI H-21 tows mine-sweeping paravanes during Navy tests of new tug technique developed by the helicopter's manufacturer.

Navy Will Sweep Mines with Helicopters

Application of the helicopter as an aerial tug to sweep enemy minefields was disclosed last week by the U.S. Navy and Piasecki Helicopter Corp.

The new technique, for which Piasecki claims its tandem design has many advantages, practically eliminates the inherent threat of having the lead minesweeping vessel blown up in clearing a harbor for entrance of transport and cargo vessels.

▶ **Florida Tests**—In practice, the helicopter is used to precede conventional minesweeping ships, clearing the path for the first vessel of a V-shaped formation.

Piasecki's contract for development of a towing technique goes back three years. The company's engineers have been working with Navy mine countermeasures experts and the experimental station at Panama City, Fla., on practical tests in the Gulf of Mexico since November 1952.

Initial aircraft was the venerable HRP-1 tandem, same model used by the company in earlier work on antisubmarine warfare with the fuselage stripped to increase its load-carrying ability. For minesweeping, Piasecki developed a special tow bar and hook.

First runs with the HRP-1 proved that the helicopter could operate as fast as conventional minesweepers and in seas so rough that ships could not do the job.

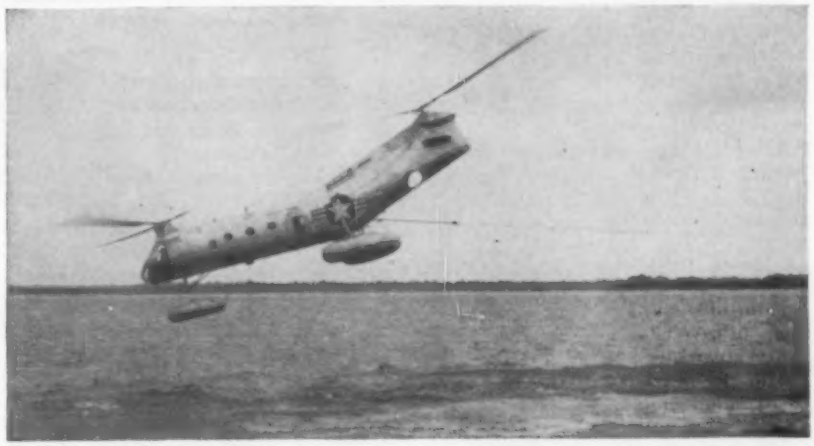
▶ **Advantages**—Further towing experiments in 1953, using the newer Piasecki H-21 Work Horse, a more powerful helicopter, demonstrated these advantages:

- The H-21 could pull double sweep gear as fast or faster than a minesweeping vessel.
- Maneuverability of the copter in restricted areas was superior to that of the surface vessel.
- Ability to operate from landing platforms on surface ships increases flexibility of minesweeping forces.
- The helicopter can produce a towing pull equal to several times its normal lift capacity, flying in a sharp nosedown attitude.
- The towing cable provides additional stability, making the pilot's job easier than in normal operations.

Both Piasecki and the Navy predict development of the towing technique with minesweeping as the prime mission will lead to other applications. These include:

- As a tug to tow disabled vessels, of utility to both the Navy and the Coast Guard.
- To free bogged land vehicles, such as trucks stuck in the sand on a landing beach, surf, swamps or snow, a use that can be adapted to Marine operations.

According to the company, the HRP-1, powered by a 600 hp. engine, exerted a pull of 5,000 to 6,000 lb. in tests pulling a mired truck from the sand. Navy did not release figures on the pull exerted by the H-21, but it carries an 1150-hp. engine in the version used at Panama City.



TOWING ATTITUDE of H-21 mine sweeper is nose down to get maximum pulling power.

RESCUE OPERATIONS also are demonstrated by H-21, shown here towing Navy PT boat.

Army Creates Aviation Division

By Claude Witze

U. S. Army in the last two months quietly brought about three changes in administrative control over its fast-growing aviation organization. All aim at Army's taking over complete responsibility for its aircraft program. They are:

- Creation of a new Aviation Division in the Office of the Assistant Chief of Staff, Operations (G-3).
- Shift of Maj. Gen. James M. Gavin, chief of G-3 and an aggressive proponent of airborne mobility, to a new job as Deputy Chief of Staff for plans and research.
- Redesignation of the Army's aviation school at Camp Rucker, Ala. It now is known as the Army Aviation Center.

Before its elevation, Army aviation was a branch in the Organization and Training Division of G-3. Top officer was Col. Warren R. Williams, Jr., who now has a new superior, Brig. Gen. Hamilton H. Howze.

▶ **Rapid Growth**—The change removes Army aviation from the jurisdiction of Brig. Gen. L. V. Hightower, chief of organization and training, and puts it on a level with his division and two others, operations and plans.

Army explanation of the new setup is that growth of its aviation activity, started a few years ago with a single officer after formation of an independent U. S. Air Force, has arrived at the point where steps must be taken to insure proper direction and control.

Gen. Gavin's appointment to succeed Lt. Gen. Lyman L. Lemnitzer as Deputy Chief of Staff for Plans and Research follows by only two months a shakeup that saw all Army research and development work placed under the supervision of that office (AW Jan. 10, p. 14).

▶ **Logical Step**—There was speculation at the time that placing full responsibility for R&D in Lemnitzer's office was a possible prelude to assumption by the Army of more responsibility over its aircraft development and production contracts. Shift of Gen. Gavin to this job is a logical step in this expansion of Army control.

Widely known as a veteran airborne officer, Gavin is a strong backer of the airplane and helicopter as modern vehicles to move troops and supplies to the battle line. He is the principal figure in pushing Army's program to equip more than 30 helicopter transportation companies in the next five years.

There are strong indications that the Army feels R&D may be the most important field for activity to make its air mobility program a reality.

BRIG. GEN. HOWZE

Three factors strengthen this view:

- **General dissatisfaction** with the present procedure under which Army aviation R&D projects are supervised by the Air Force, along with procurement of aircraft.
- **Equal dissatisfaction** with the theory that Army must buy "off-the-shelf" equipment whenever possible, which may force its specific needs to take second place in development of new aircraft.
- **Obvious necessity** for accelerated R&D programs to improve present rotary-wing equipment and speed the advent of faster and bigger aircraft, probably from among proposed convertiplane configurations.

The division will have three civilian employes.

▶ **Responsibilities**—The new division will perform all the duties assigned to G-3 in 1952 when the old aviation branch was created. These include:

- **Preparation** of the Army aviation program for each fiscal year, with estimates designed to "make aviation fully responsive to the needs of the Army."
- **Coordination and supervision,** including contacts with the Air Force and Navy where necessary.
- **Cognizance** in personnel, training, intelligence and logistics to help staff agencies solve problems in these fields.
- **Control** of army aircraft.
- **G-3 representatives** on boards, committees and panels when required.
- **Monitor organization,** maintenance and employment of aviation by the Army in the field and make recommendations where necessary.
- **Promote activities** in aviation that will increase the mobility and combat effectiveness of the Army.

▶ **Ex-Calvary Officer**—Gen. Howze, head of the new division, is a 46-year-old graduate of West Point and veteran officer of the calvary, intelligence and armored branches of the service. His assignment before moving to the Pentagon last month was deputy chief of staff for plans of the 7th Army in Europe.

Plans for major growth of Camp Rucker were indicated several months ago when the aviation school was moved there from Ft. Sill, Okla. A former tank repair base, Camp Rucker's facilities are being adapted for aviation work and to house the board responsible for testing new aircraft.

Lobbying Costs AIA $18,616 During 1954

Aircraft Industries Assn. listed expenditures of $18,616 during 1954 in connection with legislative activities in its report filed under the 1946 lobbying act.

John Floberg, former Assistant Secretary of the Navy for Air, made a new registration as representative of the Conference of Local Service Airlines at an annual compensation of $20,000.

Other expenditures reported for 1954 included:

Harry Brashear, De Witt Ramsey and Harold Mosier filed individual reports as representatives of AIA. Mosier listed an expenditure of $2,473. Brashear and Ramsey listed no expenditures. Avery McBee, as representative of Hill & Knowlton, Inc., reported no expenditures.

Edward Rodgers and S. G. Tipton filed as representatives of Air Transport Assn. Rodgers reported an expenditure of $1,493, Tipton $128.

John C. Cone, representative of Pan American World Airways, reported no expenditure.

Larry Cates, as representative of Air Line Pilots Assn., reported an expenditure of $1.20.

Wayne Weishaar, representative of Aeronautical Training Society, reported an expenditure of $14.88.

Douglas Sells 109 Airliners in 60 Days

Douglas Aircraft Co. sold 109 DC-6 and DC-7 transports to 17 airlines during the first two months of 1955. Combined value of the sales totaled more than $180 million.

The orders increased the company's two-year commercial backlog for transports to 208 valued at $350 million, largest in Douglas history. They raised sales of DC-6 and DC-7 types, including military versions, to 819.

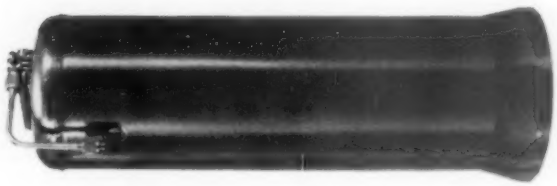
Transports purchased in January and February were 49 DC-6s and 60 DC-7s, including 38 long-range DC-7Cs.

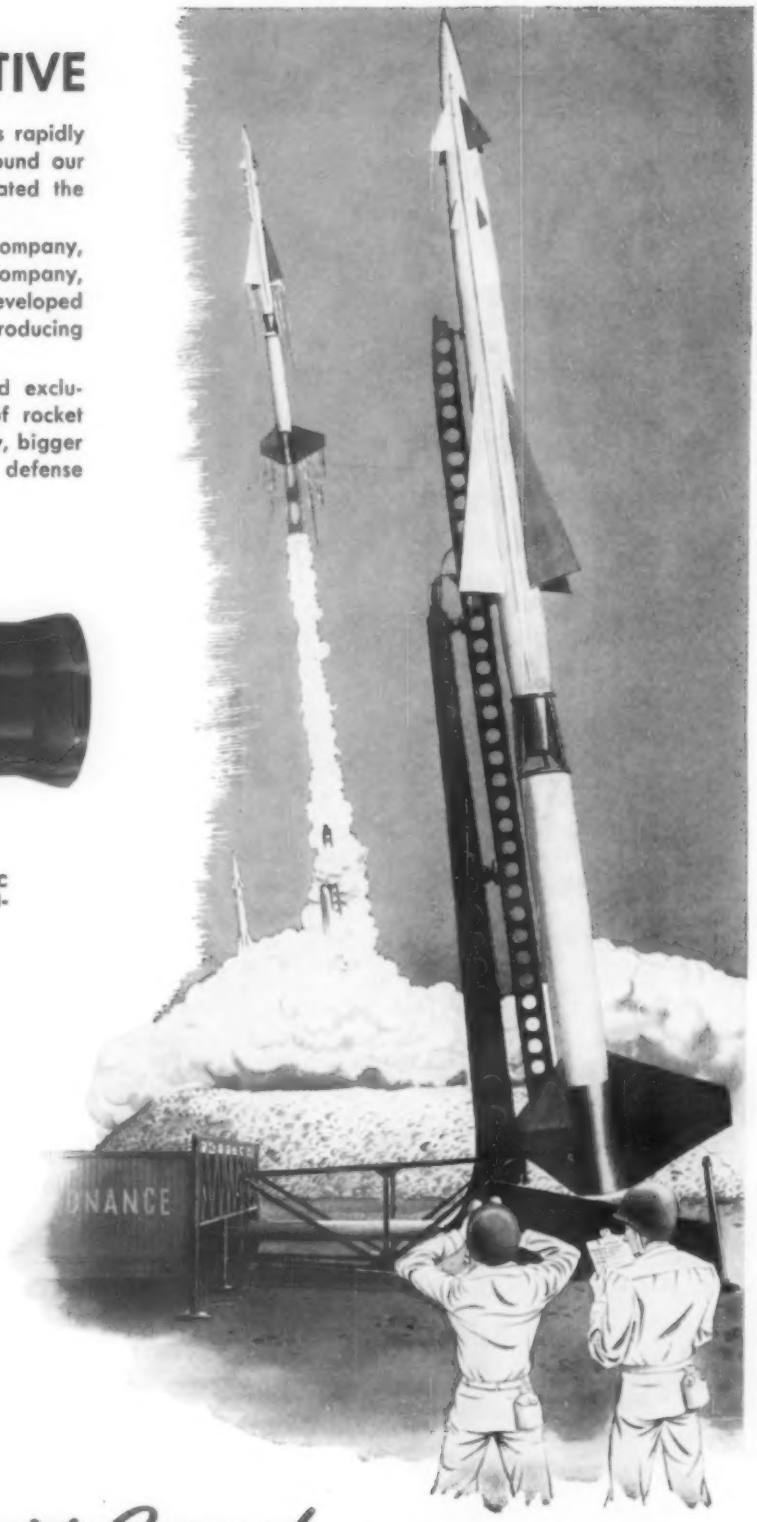
NIKE: PROOF POSITIVE

Nike, a tactical air-defense weapon that is rapidly being installed by the U.S. Army in and around our most strategic defense areas, has demonstrated the reliability and producibility of rocket power.

Under subcontract to the Douglas Aircraft Company, which is associated with the Western Electric Company, prime contractor on NIKE, Aerojet-General developed the sustainer rocket motor for NIKE and is producing them for Douglas in large quantities.

The largest industrial organization devoted exclusively to the development and production of rocket powerplants, Aerojet-General is supplying new, bigger and better rocket power for the Nation's defense program.





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- **Underwater Propulsion Devices**
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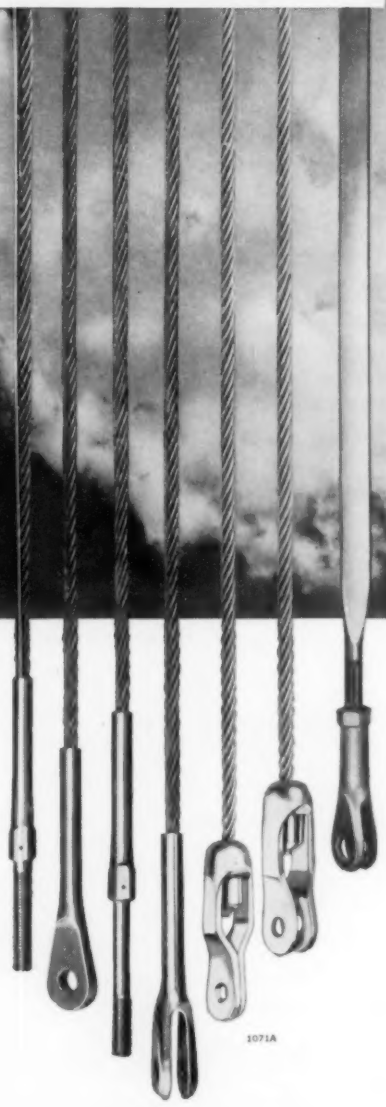

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* *"Hi-Fatigue" is a registered trademark.*

RAF Shows Off Hunter Units, Hoping To Silence Critics

(McGraw-Hill World News)

London—Royal Air Force publicly displayed its three squadrons equipped with Hawker Hunters in an effort to convince British press critics of their military aircraft development and production program that these sweptwing fighters actually are going into service with combat units.

Two of the three squadrons are equipped with the Hunter Mark II, powered by an Armstrong Siddeley Sapphire turbojet, while the other has Hunter Mark I, powered by the Rolls-Royce Avon turbojet. Both engines deliver about 7,500 lb. static thrust without afterburner. Later versions of the Hunter are scheduled to be powered by 10,000-lb.-thrust versions of the Avon and Sapphire.

▶ **Gun Gas Trouble**—Currently, Hunter engines are encountering trouble when the four 30-mm. Aden cannon are fired at altitude (AVIATION WEEK Feb. 14, p. 7). Gun gas enters the engine air intakes causing oxygen starvation and flameouts. Avon-powered Hunters are more seriously affected by this problem than those using the Sapphire.

All Hunters will be modified with cartridge link collectors to catch the metal links in the Aden cannon ammunition belts in flight. Ejected links now chew up rear fuselage speed brake, even when it is retracted. The link collectors will require external bulges on the under side of the fuselage. Shell casing are now ejected down and to the rear through chutes to clear the aircraft.

▶ **Pilot Protection**—RAF sources at the public display said the Hunter is subsonic in level flight but can get just over Mach 1 in shallow dives. It has a powered-control system with a pressurized and air-conditioned cockpit. The pilot is protected by armor plate at his back and a bullet-resistant glass panel in the canopy. Martin Baker ejection seat is installed.

The Hunter carries its internal fuel in fuselage and wing tanks and recently has been fitted with two expendable plastic external tanks.

The Hawker fighter is equipped with automatic gun-ranging radar installed just forward of the cockpit. Scanner is enclosed in a laminated plastic nose radome. Radar operates with a gyro gunsight and provides automatic target range information. It also can be controlled manually by a twist grip on the pilot's throttle lever.

▶ **New Gun Pack**—RAF ground crews demonstrated methods of replacing the detachable pack containing the four Aden cannon (AVIATION WEEK Oct. 4, 1954, p. 11) and refueling that enabled them to have a Hunter fully re-serviced for combat in seven minutes. In changing the gun pack, the Aden cannon are removed complete with barrels, ammunition chambers and breech and new guns installed. The pack, complete with gun and full ammunition load, weighs 1,900 lb. Each Aden cannon can fire 1,200 rounds per minute.

In an alert and scramble demonstration, 13 Hunters were on the line with pilots in cockpits. Using cartridge starters simultaneously the first Hunter got rolling in 1 min. 59 sec. with the rest following at 15-sec. intervals. Dozen Hunters got off the line in 3 min. 35 sec. One failed to start due to mechanical trouble. In 6 min. 15 sec. all 12 Hunters were lined up at the end of the runway for takeoff.

Another demonstration had these 12 stop their engines at the end of the runway and the scramble to takeoff. Using cartridge starters they were all ready for takeoff within 1 min. 20 sec., and the first Hunter was off the ground in 2 min. 5 sec. after the scramble order. All 12 were in the air within 3 min. 29 sec.

USAF Rating

Maj. H. N. Tanner, USAF pilot who commands one of the three RAF Hunter squadrons on an exchange assignment, rates the British fighter as better than both the North American F-86 Sabre and the Russian MiG-15 fighters, but believe it is inferior to the F-100 Super Sabre now being put into squadron service in USAF. The Sabre and MiG-15 have been operational since 1950 and had two years combat against each other in Korea while Hunter development was lagging in Britain.

NACA Construction Wins House Approval

The House passed legislation authorizing an $8.45-million construction program by National Advisory Committee for Aeronautics, after several members praised the agency.

Authorization for $4.85 million for construction of a nuclear reactor at the Lewis Flight Propulsion Laboratory is being considered separately to integrate the project in Atomic Energy Commission's reactor program.

NACA's request for $13.3 million to finance the construction program is pending before the House Appropriations Committee in the 1956 fiscal year budget.

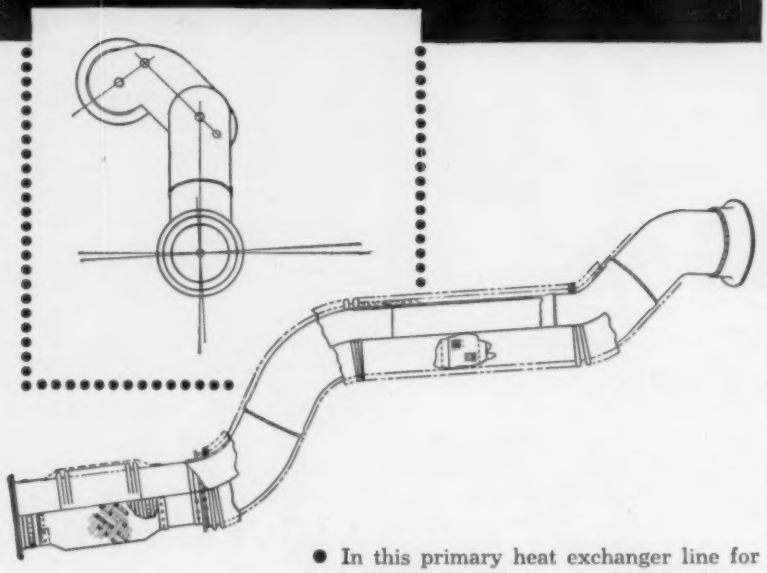
Details of the works planned are:

• **Langley Aeronautical Laboratory, $3,395,000.** Installation of an air-removal system for the 16-ft. transonic tunnel will extend its speed range to include Mach 1.2, and provide for testing of large-scale models to determine characteristics of aircraft that become critical in the low supersonic range.

• **Ames Aeronautical Laboratory, $1,055,000.** A high-speed, free-flight facility will provide for investigations into the tremendous heat generated by missile speeds from 7,000 to 14,000 mph. A steel pipe firing test chamber and instrument room will permit investigation of airplane heating and stability at speeds from 2,000 to 6,000 mph.

• **Lewis Laboratory, $3,910,000.** Con-

FLEXON INSULATED DUCTING
COMBINED WITH FLEXIBLE SECTION
HANDLES 205 psi AT 820° F.



● In this primary heat exchanger line for one of the nation's newest fighter planes, Flexonics Corporation has successfully combined a variety of design elements.

The duct is subject to a temperature range of −65° F. to 820° F. and must withstand air pressure of 205 psig. at 820° F. The flexible section must handle ¼" compression with a compression force of 50 pounds. Fibrous insulation, sealed in a stainless steel outer shell, must meet heat loss standards of the airframe contractor and yet be able to follow the thermal motions of the duct.

The unit illustrated meets these conditions by combining Flexon stainless steel ducting in multi-plane configurations with a stainless steel corrugated section. Insulation is also lightly corrugated to permit movement with the thermal expansion of the duct.

The experience and know-how of Flexonics Corporation in the design and fabrication of intricate assemblies such as this are your best assurance of getting the quality you need in your requirements. For recommendations on resolution of your ducting problems, just send an outline of your needs.

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FLEXON DUCTING, standard or high strength corrosion resistant, is available in varying wall thickness and in a complete range of sizes, with or without insulation. Elbow forming and rib reinforced types can also be supplied.

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FORMERLY CHICAGO METAL HOSE CORPORATION

Flexon identifies products of Flexonics Corporation that have served industry for over 53 years.

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In Canada: Flexonics Corporation of Canada, Ltd., Brampton, Ontario

version of the 8x6 ft. tunnel will permit transonic operation. Two test cells are planned for research on high-energy fuels for ramjets and turbojets.

Praise for NACA included these statements on the House floor:

Rep. Carl Durham: "I have always been impressed with the attitude of the people at NACA. They have but one thing in mind. How to build better airplanes than any other country in the world. . . .

"I have no doubt that many of the scientists and other personnel of the NACA could benefit themselves greatly from a financial standpoint by leaving the NACA and going with aircraft manufacturers and private research groups."

Lockheed Prop Device Cuts Cabin Noise 25%

Burbank, Calif.—Lockheed Aircraft Corp. has announced a new propeller synchronizing system designed to make airline travel 25% quieter.

The combination electrical and hydraulic system was developed by Lockheed flight test engineers to reduce noise in the passenger cabins of transports.

▶ **Millionth Accuracy**—The device, referred to as a "synchrophasing" system, keeps propeller blades in step with an accuracy of a millionth of a second, according to C. L. Johnson, chief engineer of Lockheed's California Division.

Flight tests have indicated that the exact reduction in sound level varies throughout the cabin but averages approximately 25%.

"Synchrophasing actually cuts sound two ways," Johnson said. "It reduces sound volume by 10 decibels and smooths and evens the remaining sound to make it more acceptable to the ear."

Working with Lockheed on the system were the Hamilton Standard Propeller Division of United Aircraft Corp. and the Curtiss Propeller Division of Curtiss-Wright Corp.

▶ **$20,000 per Plane**—No airline orders have been received for installation of the system, Lockheed reported. But the device may become standard equipment on future Lockheed transports.

No announcement of the cost for installation on present airliners was made by the Burbank firm, but such a system probably could be installed for less than $20,000 per aircraft.

Weight of the total system is estimated at 65 lb.

▶ **Specified Relationship**—Synchrophasing, Johnson explained, is a means of controlling the propellers to turn at a specified relation to each other and at precisely the same relative angle to the fuselage. Vibration forces from propeller tip air blast are reduced 75%

Bendix International in Aviation

The part of Bendix in the technical progress of aviation is vast and varied. Because Bendix has always anticipated aviation's next advance, every plane that flies, in some way, relies on Bendix Creative Engineering.

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WESTERN AIRLINES

at the points where these forces strike the passenger cabin.

To keep the propeller blades in proper phase, an electronic governor is used. The governor takes its cues from magnets installed on the spinner of each propeller and from coils on each engine nacelle. When the magnet passes the coil it sets up an electrical impulse. The impulse thus generated travels electrically to the governor, which compares the timing of impulses from each nacelle.

If these impulses differ by more than one-millionth of a second, the difference is corrected. Correction on hydraulically actuated propellers is made through an electrical connection from the electronic governor to the flyweight governor of the propeller. This brings the offbeat propeller into phase with its mates.

On electronic propellers, the motor in the dome of each spinner reconciles the propellers.

Atlantic Air Freight Agreement Approved

Operation of Airwork's North Atlantic cargo service by Slick Airways and Transocean Air Lines has been approved by the Civil Aeronautics Board.

Slick and Transocean will run weekly airfreight service between New York and London under terms of the foreign air carrier permit issued Airwork Apr. 1, 1954. Airwork has an order for DC-6A airfreighters, but delivery won't be made until early 1956, and Airwork wants to get into operation before that.

▶**Agreement Terms**—Under the terms of the approved agreement, Slick will operate regularly weekly roundtrip flights with DC-6A equipment between New York and London and New York and Shannon, Ireland. Slick will pay operating and maintenance costs, carry necessary insurance and furnish all flights crews. Under these conditions, Slick will be paid $560 per aircraft flight hour.

Transocean will also operate weekly

Sabena Expands

Sabena Belgian airlines, next month will extend its helicopter network with a new route between Brussels, Eindhoven, Duisburg and Essen.

Sabena has purchased two more Sikorsky S-55s as the first step in expanding helicopter service to several other West European cities.

The Belgian airline has carried more than 27,000 passengers with its initial fleet of four helicopters since services started in August 1953.

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Today's airplane is no longer controlled in flight by manpower alone. Hydraulic power is now widely employed to provide control surface power made necessary by larger surfaces and higher speeds.

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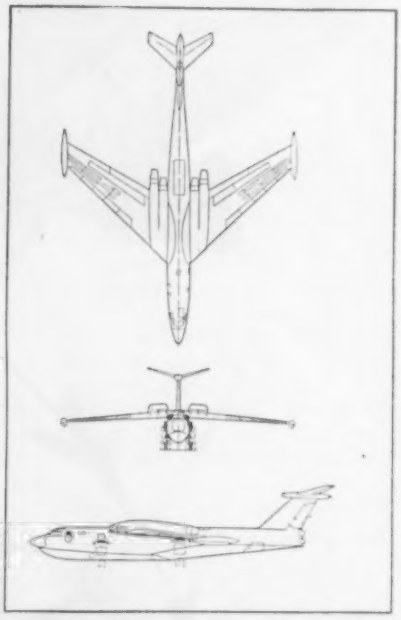
flights from New York to either London or Shannon, using DC-4s. The American company will pay all operating and maintenance costs, carry insurance and furnish flight crews. Terms of payment call for $10,000 for New York-London roundtrip flights, $8,500 per New York-Shannon roundtrips and $500 for London-Frankfurt roundtrips—about $300 per flight hour.

Airwork will pay landing fees, load cargo and take care of customs clearance. Both agreements terminate with the conclusion of the last flight scheduled during the week ending Mar. 3, 1956, subject to extension by Airwork.

► **Charter Deal**—In the agreement with Slick, Airwork has the option of using its own flight crews and paying flight operating expenses. On flights where Airwork furnishes its own crews, Slick will get $325 per flight hour. Airwork is interested in breaking its own personnel in on the DC-6s prior to delivery of its own aircraft.

As long as Slick operates the flights, CAB considers the deal a charter rather than a lease. If Airwork should decide to use its own crews, the agreement would become a leasing proposition and CAB approval would be necessary.

CAB has also authorized Airwork to



XP6M Design Details

First official three-view drawing of Glenn L. Martin Co.'s new XP6M-1 SeaMaster points up the sweptwing jet-powered flying boat's unusual design. Of particular interest are the long-length narrow-beam hull, fixed plastic wingtip-mounted floats, swept T-tail and mounting of four Allison J71 turbojets atop wings. Hatch in top of the SeaMaster's hull permits loading of mines and other weapons, carried on a rotating bomb-bay in the hull bottom.

add Manchester as a co-terminal with Prestwick and London and to add Shannon as an intermediate point.

CAB to Ease Foreign Aircraft Certification

Proposed changes in Civil Air Regulations to permit type certificates for foreign aircraft and related products under terms of reciprocal agreements with countries manufacturing the planes and certifying them have been issued by Civil Aeronautics Board.

U. S. now has nine bilateral agreements in effect providing for reciprocal recognition of certificates of airworthiness for imported aircraft.

▶**Foreign Resurgence**—Certification of aircraft under the bilateral agreements has caused difficulties, CAB says, because these agreements provide only for airworthiness and not type certificates. The Civil Aeronautics Act requires a type certificate as a prerequisite to an airworthiness certificate.

The bilateral agreements were all concluded prior to the Civil Aeronautics Act of 1938 and had little practical effect until recently, during a resurgence of civil aircraft design and manufacturing—particularly in Europe. This resulted in requests for U. S. certification of foreign-manufactured aircraft.

A new part of 10 of CAR, would permit the Civil Aeronautics Administrator to issue certificates and approvals if the country with which the U. S. has a bilateral certifies that it meet CAR standards for aircraft built in the U. S. The new rule also would require that technical data be furnished by the foreign manufacturer if requested.

Aircraft and related products which become certificated would be designated as "import" and labeled as such.

House, Senate Fill Subcommittee Posts

Rep. Tom Steed, Oklahoma Democrat, is the new head of House Small Business Committee's Subcommittee on the Aircraft Industry.

Other subcommittees and their chairmen are: Regulatory Agencies, Rep. Joe Evins; Small Business Administration, Procurement, and Loans, Rep. Abraham Multer; Minerals and Metals, Rep. Sidney Yates; Distribution Proposals, Rep. James Roosevelt.

Senate Small Business Subcommittees include: Monopoly, Russell Long; Military Procurement, Sen. George Smathers; Relations of Business with Government, Sen. Edward Thye.

Sen. John Sparkman and Rep. Wright Patman head the full Small Business Committees of the Senate and House, respectively.

ERCO BACKS A BOMBING MISSION

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The Mark 12 auxiliary fuel tank, used extensively in Korea both as a fuel tank and as a standard Napalm (fire) bomb, adds its 150-gallon fuel capacity to regular tanks on fighting aircraft.

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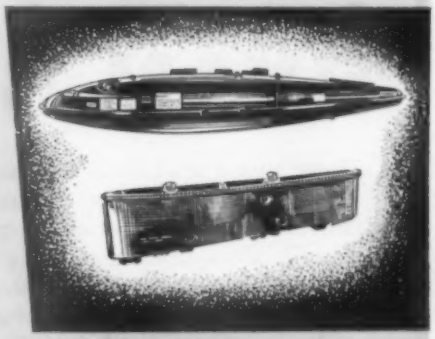

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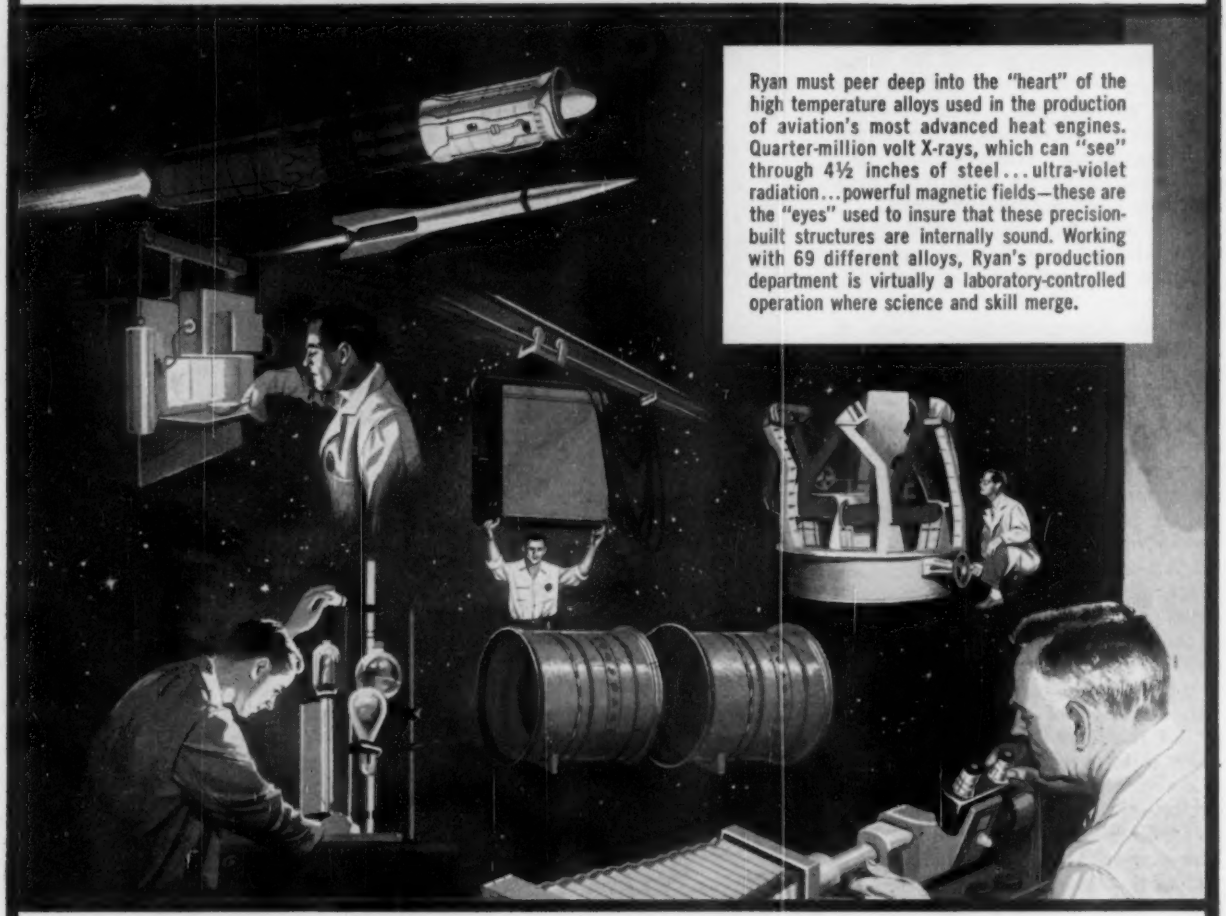

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Scientist Shortage Threatens Defense

By Henry Lefer

The gap between America's need and America's supply of trained technical-scientific manpower is large, and growing larger. There is hope that it will be closed in the next few years. But in the meantime, says a leading research group, "We are sitting on a time bomb."

Donald A. Quarles, Assistant Secretary of Defense (R&D) warns: "The critical shortage of engineers and scientists in America is potentially a greater threat to national security than are any weapons known to be in the arsenals of aggressor nations."

It is an axiom of defense planning that the United States and its allies cannot hope to match the Moscow-Peking axis man for man. Russia and China between them, not counting the other satellite nations, have a population of more than 750 million. The cold war, in the words of Quarles, "is a technological race with the Communist world."

▶ **Losing the Race?**—How are we doing in this race? Not too well.

At the present time, the U.S. has about 500,000 engineers and 200,000 scientists; Russia has 400,000 and 150,000. But we are graduating fewer than 20,000 engineers a year, a figure that is expected to rise to about 27,000 in 1956, a peak of 34,000 in 1957, and then decline.

Contrast this with Russia. From a 1952 engineering graduate roll of about 30,000, the rate has risen steadily and is expected to reach 45,000 in 1956.

Add to this picture the figures for technicians—the men who maintain the complex equipment on which our security is based and who assist more highly trained engineers and scientists in their jobs.

Russia maintains 3,700 technicums (technical training schools) whose present enrollment is about 1.6 million students, analysis of official Russian documents indicates. In the U.S. there are about 1,000 two-year technical schools with a total enrolment of 50,000. These figures do not include technical establishments maintained by USAF, which are extensive. But there is no reason to believe that Red Air Force efforts in this direction are less extensive.

▶ **Air Force's Loss**—Look at our Air Force manpower situation. Airmen are leaving the service at an annual rate of 60% at the end of their first four-year hitch. Even if they can be replaced physically by recruits, the long process of turning green trainees into skilled mechanics and technicians must begin again.

"Every time a skilled man leaves the Air Force, it costs our country a little fraction of its security, it costs us a valuable national asset, which can't quickly be replaced," says USAF Secretary Harold E. Talbott. It costs time, of which there is never enough. It costs dollars, too—$608,000 for a B-47 pilot, says Talbott, $75,000 for an electronics expert, about $15,000 as an average figure.

Engineers & Scientists

A World War II fighter produced by a leading aircraft company reached first flight after 110,000 engineering man-hours. It took the same company 1,340,000 engineering man-hours to bring a new jet to first flight. Another company reports an investment of 8 million engineering man-hours for development of a new bomber.

These figures refer to specific aircraft projects, but typify the increasingly technological basis of our society. While our population is doubling every 50 years, need for skilled workers is doubling every 20 years and for engineers and highly trained scientists every 10. Right now, engineers and scientists make up only 0.5% of our total population.

▶ **Why Study?**—But scientific vocations apparently do not have a strong enough appeal for our young people. One reason is economic. It takes an average of 27 years for an engineer to catch up financially with his brother who went directly from high school to a job as, let's say, an electronic technician, says John F. Victory, executive secretary of

AIRCRAFT INDUSTRY DEMAND for engineers dominates "help wanted" columns.

the National Advisory Committee for Aeronautics.

This takes into account the pay the technician was receiving while the engineering student was paying for his schooling.

Jobs for the high school graduate are plentiful and the prestige of the scientific career seems insufficient to persuade the young man to put off going out on his own and getting married until after he has gotten a thorough professional education. Of those high school graduates who have the makings of engineers or scientists, only half go to college and only about 40% finish college.

Thus six of every 10 potential engineer-science students do not get a college degree. Only 2% of our college graduates go on to become PhDs. And in this country, of the 50,000 holders of advanced degrees, perhaps one-fourth are specialists in science and engineering; the remainder hold degrees in the humanities.

▶**Behind the Deficit**—Aggravating the situation is the comparatively small crop of young people of college age, result of the low birth rate of the Depression-Thirties. We have already felt the worst of this, and should be on the upswing now.

A factor which hit the engineering profession specifically was the prediction by a government agency shortly before Korea that we were heading into a period of engineer surplus. But, Korea and the warming up of the cold war converted the expected surplus into an uncomfortable shortage. The effects of this situation also are waning.

Projections show that we will need an average of 30,000 new engineers a year through 1956. For the period of 1953-1956, this adds up to 120,000. We expect to graduate 85,000 during this period—a deficit of 34,500. But of the 85,000 graduates, 38,300 are members of the ROTC and have a military service obligation after graduation. Some of these will later be available as engineers or scientists to industry or government, but this will be after 1956. In the meantime, our total indicated shortage of engineers by the end of 1956 will be 73,800.

▶**Reds Push Science**—The picture in Russia is entirely different.

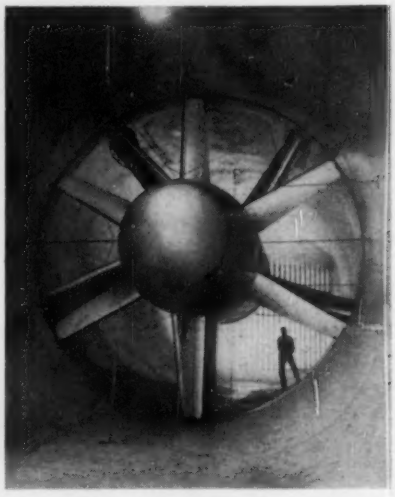
Science training is encouraged. Students are paid during their schooling. The prestige and pay connected with scientific careers is such that as many as eight applicants are reported for some school openings. This makes it possible to choose the "cream of the cream" for technical and scientific training.

The Russians are said by our scientists to be especially outstanding in aerodynamics, nuclear physics, solid state physics, low temperature physics, psychology and some aspects of electronics. An indication of their electronics progress was given when the cruiser Sverdlov showed up at the British coronation ceremonies bristling with an assortment of search and fire control radar antennas in every respect comparable to one of our own cruisers in the same range.

Another example: the very effective and extensive system set up to jam our Voice of America broadcasts. American scientists do not underrate the quality of Russian technology.

▶**Seven Institutes**—The Reds maintain seven "aviation institutes" that give a 5½-year degree whose rough equivalent would be an American "BS-and-one-half" degree. Current graduating classes of these institutes should number between 1,700 and 2,000. The comparable figure for the U.S. is perhaps 750 (a drop from 1,481 in 1951).

These seven institutes train engineers in aircraft structure, engines and propulsion devices, service and flight control equipment, and aircraft armaments. In addition training is provided in specialties such as aerodynamics, hydrodynamics, heat transfer, gyros and stabilization devices, ballistics, electronic control devices and automation techniques.



Vought Lowspeed Tunnel

Critically needed data in the 200-mph. range, particularly on landing and takeoff behavior of new aircraft and missiles, will be gathered in Chance Vought, Inc.'s new $900,000 lowspeed windtunnel recently opened. Tunnel throat measures 7x10 ft. Although the speed will be comparatively low, data obtained may be predicted up to 500 mph. The fan is a 20-ft. Sitka spruce unit, hand carved Chance Vought personnel and driven by a 1,500-hp. electric motor. Wind speeds up to 265 mph. have been developed. For year-round operation, a cooling system sprays 800 gal. of water per minute over the exterior during hot weather.

Students are exempt from the draft, even in time of war. Upon graduation, they enter on a short period of basic military service, then are commissioned and placed in the inactive reserve.

Russian scientists get generous living allowances, good housing and other material advantages. Their achievements are widely reported in the press and special prizes and awards are frequently given. All of this adds to the prestige of the group.

In general, engineering and technical graduates have no choice as to their place of employment. The state tells them. Like other totalitarian techniques, this may be more efficient and effective in the short term than voluntary choice of employment. However, it is just this freedom of choice that helps make our system worth defending against the Reds.

▶**Advanced Degrees**—There are other aviation schools of professional level in the USSR. They include an industrial academy for aircraft industry management and planning personnel, a top-notch military aviation engineering academy, four major military aviation engineering schools and two civil aviation engineering schools. The Red air force operates a number of engineering schools also, which are not of professional level.

Six of the seven aviation institutes provide graduate training, as do the military aviation engineering academy, the research institute of the Academy of Science, and four major research institutes operated by the Ministry of Aircraft.

Total number of research scientists in the USSR in 1952 was 68,000, of whom 48,000 were engaged in basic research. Obviously, this figure is now higher.

▶**Many-Front Attack**—What are we doing in the face of all this? What can we do? The attack on the problem is underway on many fronts.

The National Science Foundation conducts studies and awards grants and fellowships for basic research in the natural sciences. It sponsors meetings and conferences of scientists and teachers. It maintains a register of scientific manpower. NSF is charged by the government with the job of promoting and cultivating science in this country.

▶**NSF Grants**—For the year ended June 30, 1954, NSF made grants of almost $3.9 million to 170 institutions for various projects. Of this amount, more than half went for work in mathematics, physics and the engineering sciences. The organization sponsored 736 fellowships, of which 657 were for pre-doctoral work, 79 post-doctoral.

Through the foundation, the U.S., along with the USSR and about 40 other nations, is sponsoring the International Geophysical Year, 1957-1958.

Our share of the IGY program will include studies of solar radiation (which affects weather, radio communications, radio navigation systems), meteorology (including atmospheric balloon programs at the North and South Pole), upper atmosphere (rockets), ionospheric physics, geomagnetism, cosmic rays. A total U.S. outlay of $13 million is planned. Preliminary work has already started.

National Science Foundation runs a Russian translation service. At present it translates about 1,000 pages per year of significant mathematical papers.

▶ **Industry's Role**—Industry is starting to carry an increasing share of the burden of maintaining and increasing our technological lead. A survey of eight aircraft manufacturers shows that these companies sponsor a total of nearly 1,300 scholarships a year in engineering and allied fields.

One company provides financial assistance to 700 employes who are studying engineering part-time. Another company provides leaves of absence for those wishing to study engineering full-time. This pattern of scholarships and financial aid to employe students is widespread throughout the industry.

One manufacturer asks high school principals to recommend outstanding graduates who cannot afford to go on to engineering schools. These are hired to work a 30-hour week, giving them time to attend school. If they complete their studies, the company refunds their tuition.

There are other programs. General Motors recently announced one of the largest—a $2-million-per-year plan under which 350 four-year scholarships will be made available, plus annual grants-in-aid of $500-$800 each to be spread among 306 colleges. Added to previously announced GM programs, this will cost the company $4.5 million a year after four years. Westinghouse has awarded science scholarships for many years. There are many other such plans, large and small.

In a sense, programs such as these represent nothing but enlightened self-interest. A McGraw-Hill Publishing Co. study points out: "If business firms do not voluntarily go to the financial aid of higher education, there is every prospect they will soon be providing more financial support for higher education through taxation."

▶ **Teachers Needed**—One of the danger spots in our technological future is the acute shortage of qualified science and math teachers in our high schools. "More than 100,000 high school students in mathematics and science have inadequately trained teachers," says the Engineering Manpower Commission of New York. The number of those graduating from college and equipped to teach science dropped from 8,800 in

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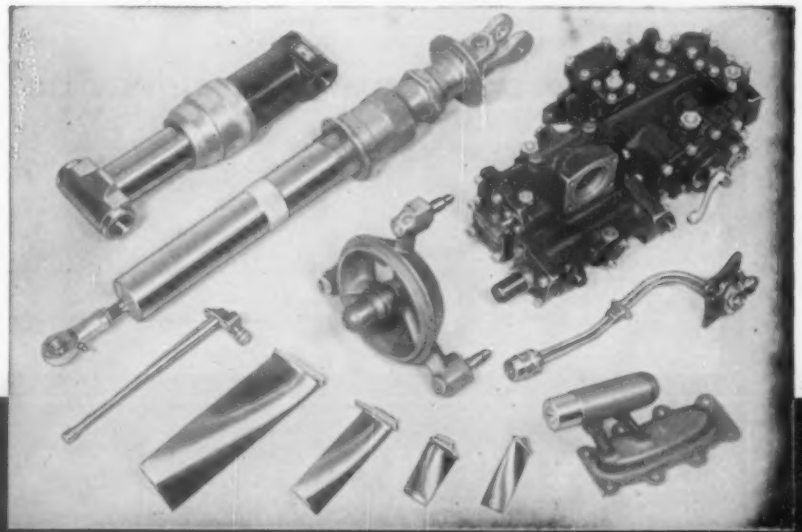

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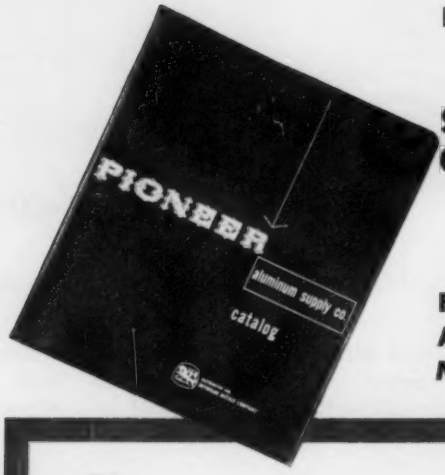

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1951 to 4,600 in 1954. Compare this with the need for new science teachers of 7,700 in 1954.

Another danger to our technological leadership is the growing stress on general studies in high school, with consequent neglect of mathematics and the sciences.

So one attack on the engineer-scientist shortage must be made at the high school level. Prestige and pay of teachers must be increased. Teachers must be given an opportunity to keep up with their specialties. Some companies are making a contribution here by providing summer employment for high school teachers.

It is suggested that industry and professional groups cooperate in arranging plant visits for school groups and in other ways keep them interested and informed.

▶ **Exposed to Draft**—A common complaint of researchers and schools is the lack of a clearcut policy on the drafting of students aiming at technical-scientific careers. Exemption from military service for any group is a politically touchy subject.

Most military service plans contemplate that every young man in the appropriate age bracket will have a taste of the military life. In actuality this does not work out, since our military manpower requirements are not large enough to include all in the eligible pool.

So actual drafting often is at the "whim of the local draft board," many scientists complain.

▶ **The Creative Years**—A very high percentage of important basic discoveries are made by men in their early twenties, scientists point out. Even if a man returns to science after his military service, they say, we have lost some of his most creative years.

The scientists' viewpoint is made clear by Dr. H. A. Meyerhoff, executive director of the Scientific Manpower Commission. Every man should put in some time in government service for the country's military protection, he believes. But this does not necessarily mean military service. Consideration should be made of the person's special ability and he should be assigned to the service which makes the most use of his ability and training.

▶ **Red Tape Tangle**—Regardless of the outcome of any programs for the increase of our supply of technical people, we will have to live with the facts of the shortage for some years. It is vital, therefore, that we make the best and most efficient use of the limited supply we have.

One way of doing this is to eliminate the red tape tangle that snarls the operation of so many scientists, especially in government. The National Advisory Committee for Aeronautics, which em-

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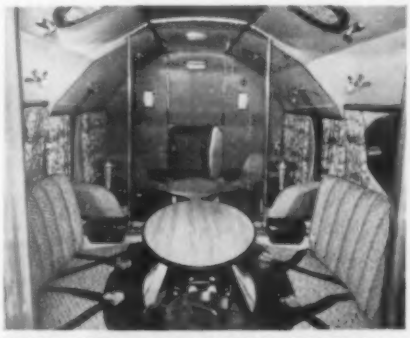

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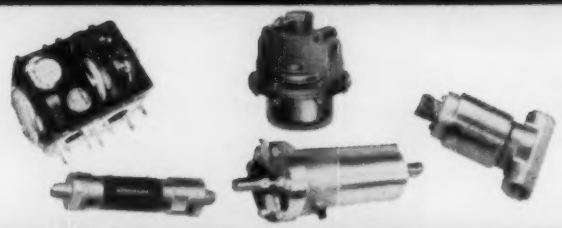

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ploys about 7,000, of whom about one-third are aeronautical and research scientists and design and facilities engineers, has made outstanding strides in this direction. The burden of red tape and administrative details has been nearly completely removed from their shoulders, freeing them to do what they were hired to do—research, says Robert J. Lacklen, NACA personnel officer.

This not only helps make better use of scientists, it helps to keep them. One of the major objections of these trained people to government service is the mass of paper work involved. "Fewer administrators and 'less administration'," is a common plea.

▶**NACA Survey**—A study conducted among personnel of NACA's Ames and Langley labs by the Interdepartmental Committee on Scientific Research and Development uncovered a number of approaches for making government service attractive.

Among the favorable factors were: freedom from pressure to distort findings for commercial purposes, opportunity for fundamental research in large, well-equipped labs, opportunity for publication of findings, contact with top scientists in and out of government.

Complaints were registered about red tape, lack of privacy, frustrations in getting research financing (indifference, fluctuating support on the part of those controlling the purse strings), loss of prestige of government service as a result of scattershot investigations, and the widespread undercurrent of opposition and suspicion throughout the nation directed against "eggheads" and intellectuals.

▶**Pay and Advancement**—There were pleas for fair pay (as compared with industry), maintenance of retirement benefits, opportunities for adequate professional recognition and growth, a policy of advancement for scientists working as scientists. Too often, the only way a scientist can advance to top levels is by taking on administrative tasks.

NACA has asked and expects to get permission to raise the pay of its lower grades, to get them within striking distance of the pay offered by industry for comparable work. A good deal of the answer consists of better public relations—getting the story across to students and to the public in general.

▶**Sensible Security**—Scientists in government feel their prestige would increase if they could wipe out the widespread feeling that our various research establishments are hotbeds of sedition.

They ask for a more sensible and grownup approach to the security problem. "The real security of the United States depends on progress," says Prof. John R. Dunning, dean of engineering at Columbia University.

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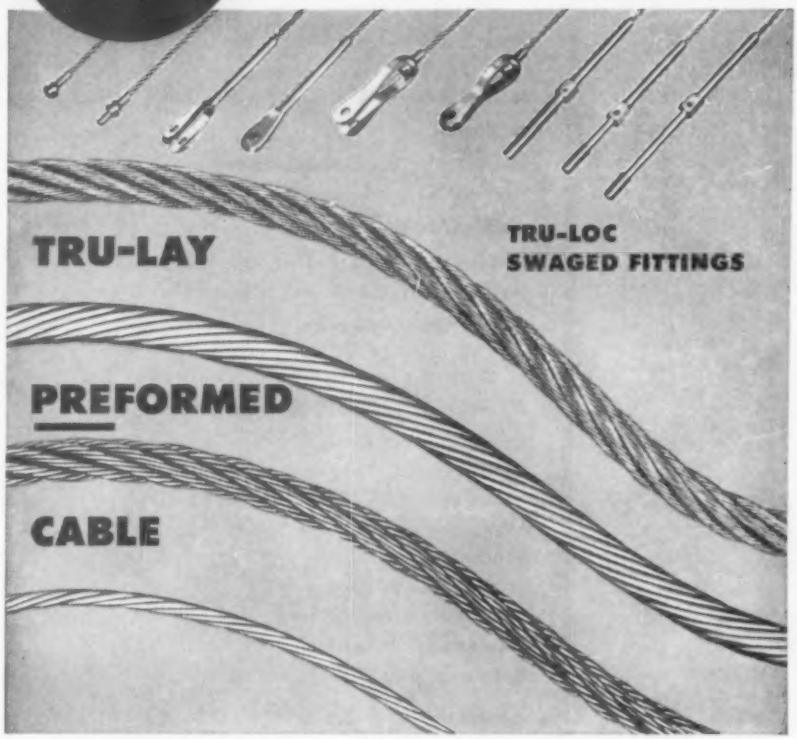

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from arbitrary and whimsical interpretations of security regulations. They point to the case of the Republic Aviation Corp. engineer who was dismissed last year as a "security risk" because he had a "psychoneurotic background" that made him too unstable for secret work. On appeal, it was discovered that some over-zealous examiner had misread or misinterpreted a notation on his record that he had been discharged from the Navy with 10% disability for nervousness caused by intense itching of neurodermatitis ("jungle rot," a tropical skin disease).

The story has a happy ending: The Eastern Industrial Personnel Security Board's appeals division reinstated him.

► **Prestige Important**—There is a curious reverse twist in the security situation—after Sen. Joseph McCarthy had charged that one of our eastern research setups was harboring a large number of disloyal employes, applications for jobs went up sharply. Some observers tie this in with the prestige angle—everybody wanted to be able to say he worked for the government on very important, hush-hush work.

It might be a worthwhile undertaking for educational foundations to sponsor a whole series of new awards and honors in recognition of scientific achievement.

All of these things provide clues as to approaches which could increase the supply of technicians for government.

► **Engineers in Industry**—Obviously, in any free competition for technical manpower, industry will get the lion's share. This is because of higher pay scales, greater opportunity for advancement, the desire to see one's labor translated into practical reality fairly early.

There are 73,000 engineers employed in the aircraft industry—one out of every 11 employes. The number will rise. The competition between employers for engineers and scientists is intense, although raiding is officially frowned upon. So is the competition between industry and government. The struggle will continue as long as the supply is short. Only if the various programs underway and contemplated succeed will the basic situation be relieved.

Meanwhile, industry must clean its house. Many complaints are heard from engineers that they are not being used to the limit of their skills. They are tied up on low-grade tasks and administrative detail which could be handled by others without this specialized training and ability.

We should follow the Russians in extensive employment of women.

Air Force

The Air Force is faced with an especially severe manpower situation. This is not so much true of pilots and

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FRIENDSHIP INTERNATIONAL AIRPORT
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officers and noncoms of long service. The danger is among the group whose first four-year hitch ends now and in the next few years.

This group includes the hundreds of thousands who enlisted in USAF in the period following the Korean war, when the Air Force goal rose from 48 wings to 78, to 95, 110 and 143, and tapered off to the present figure of 137 wings, to be reached in 1957.

► **End of the Hitch**—"These men have satisfied their obligation under the law; they have completed their contract with the Air Force. . . . There is no compelling reason for them to remain in the service," says Brig. Gen. R. H. Carmichael, Asst. Director for Personnel Procurement and Training (Reenlistment and Recruiting).

Surveys made by the Air Force show that about 60% of these men plan not to reenlist, about 10-15% signify the intention of staying in the service, and the remainder are undecided. Of those with more than four years of service, close to 70% say they plan to reenlist.

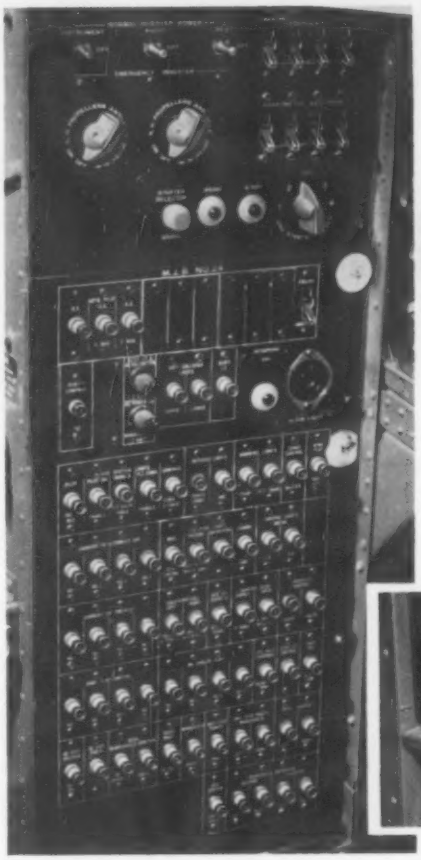
Air Force estimates that in the fiscal years 1955-1957, close to three-quarters of a million airmen will be separated from the service for various reasons. According to present intentions, about 150,000 will reenlist and 180,000 are considered unrecoverable (retired, dead, unfit or unsuited, failure to progress). This leaves more than 400,000 male airmen whom Air Force would like to hold on to.

The loss in dollars represented by this 400,000-man group has been put at $6 billion, if we accept the estimate that it costs an average of nearly $15,000 to train an airman to the level of skill represented by four years' service and attendance at various USAF schools.

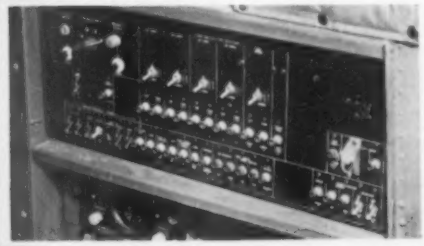
► **Half-Trained**—More serious is the consideration that this group together with the unrecoverables add up to more than half of the planned USAF level of 975,000. Projecting this situation through all major commands, one can envisage a Strategic Air Command, for instance, more than half of whose personnel is considered not fully trained. And, Air Force says, in this age of peril it is quality, rather than quantity which counts.

Air Force takes the trainee and exposes him to various specialties, advancing him from unskilled to helper to skilled levels. At the end of his first four-year enlistment, he is considered skilled or even super-skilled.

The draining of this reservoir is giving Pentagon planners many a sleepless night. Ideally, an appeal to the airman's patriotism should do the trick, Lt. Gen. Emmett O'Donnell, Jr., Deputy Chief of Staff/Personnel, points out. However, this appeal appears to be limited, and Air Force has set in mo-



TWA
Selects
KLIXON
CIRCUIT BREAKERS
For Safe, Reliable CIRCUIT PROTECTION in their New
SUPER-G CONSTELLATION



TWA has long been a famous name in commercial flying. Now, with the new Super G Constellations which TWA is adding to its fleet, faster schedules and better passenger comfort will result. To insure maximum safety and dependability TWA specifies KLIXON Circuit Breakers to protect electrical circuits.

Mr. R. W. Rummel, Chief Engineer of TWA, has this to say about KLIXON protection — "In keeping with our constant endeavor to provide the utmost in safety and dependability in airline transportation, we have selected the KLIXON type circuit breaker to achieve reliable circuit protection in our new Super Constellation 1049G aircraft."

Rugged and dependable, KLIXON Circuit Breakers withstand high shock and vibration under all flying conditions. They are precision calibrated and individually tested for ultimate trip and 200% load-tripping characteristics. Write for data giving complete details.

C6363 Switch Type Ratings: 2 to 35 amps.

D6752-1 Push-Pull Ratings: 5 to 50 amps.

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Douglas B-66 takes off for test run. Defense includes G-E armament system shown in photo above.

B-66 is first tactical bomber with radar controlled defensive armament system

The U.S. Air Force's latest twin jet bomber, the Douglas B-66 will be the first tactical bomber defended with General Electric's MD-1 fire control system. First flown in June last year, the B-66 is capable of carrying atomic bombs.

Like other G-E designed and produced defensive armament systems currently in operation, the new B-66 system is composed of control equipment, and a tail turret mounting two guns.

PROVIDES AUTOMATIC PROTECTION

A similar system, now installed on the B-47, operates as follows in performing these functions as a "packaged" tail defense.

- Automatically warns the gunner on an enlarged radar screen of approaching aircraft.
- Automatically tracks and positions the guns on selected target by means of radar.
- Continuously supplies windage, ballistics and lead corrections by means of an electric computing network.
- Fires guns electrically under control of the gunner.

HOW SYSTEM OPERATES

Briefly, here's how the system operates: When the B-47 enters a danger area, the gunner switches the radar to "search" and adjusts the system control panel to provide the computer with air temperature, altitude and air speed information.

When the radar picks up an attacking plane, a bright spot shows on the screen. By means of a control handle, the gunner easily moves the radar antenna until it is centered on the target. Once the target is "acquired" and the radar is "locked on," the target is tracked automatically.

Radar then supplies the computer with the position and range of the attacking plane. Necessary gun deflections and corrections are computed automatically. When the hostile aircraft enters gun range, the gunner presses a trigger which fires the guns electrically.

If you would like more information on the MD-1 fire control system and are cleared to receive classified data, contact your nearest G-E Apparatus Sales representative.

General Electric Flowmeter includes l. to r. power supply, indicator, and transmitter.

Mass flowmeter system aids pilot two ways

Why measure the mass of fuel? The heat content of jet engine fuel is based upon the weight rather than the volume. This means that the specific gravity varies widely with the type of fuel and the temperature. Only a measurement of the actual mass of the fuel being used at the time it is being used can give you an accurate measurement of the fuel consumption. A measurement of the volume of fuel flow allows a varying degree of error dependent upon the specific gravity of the fuel being used.

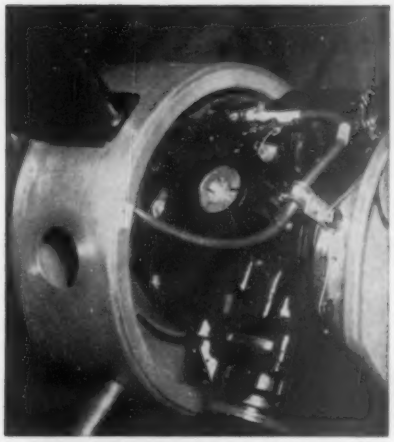
MEASURES RATES OF FUEL USED

G.E.'s mass flowmeter systems provide an individual or total rate indication for one to eight jet engines and aid the pilot or flight engineer two ways:

1. Simplifies the computation of total fuel remaining.

2. Permits a running evaluation of engine operating efficiency through comparison with the pilot's other "experience data" (altitude, flight, speed, etc.). In addition, a total rate signal may be fed into automatic cruise control systems.

For more information on how this system aids pilot and plane designer, check "A" on coupon for bulletin GEC-932.



Direct engine pad mounting is permitted by the small outline and light weight of the General Electric ball piston drive. The a-c generator is coupled directly to the drive.

Smallest and lightest A-bomber yet revealed, the Douglas A4D Skyhawk uses the General Electric 9 KVA ball piston constant speed drive.

G-E constant speed drive selected for bantam A-bomber

Requiring high performance, plus an extra weight and space reduction on the design of the A4D, Douglas chose the General Electric 9 KVA ball piston constant speed drive for a-c power supply.

The flexible nature of the G-E drive permitted incorporation of an engine starter adapter, and furnished engine starting and a-c power generation from a single pad. More reliable performance is provided by the simple mechanical operation and small number of rotating parts of the ball piston units.

For detailed information on how the G-E ball piston drive can be designed for your specific needs, contact your nearest G-E Apparatus Sales Office.

Send coupon below, and check "C" for a new bulletin, describing the many features of the G-E hydraulic constant speed drive.

New right angle lead capacitors are specially designed for printed circuits

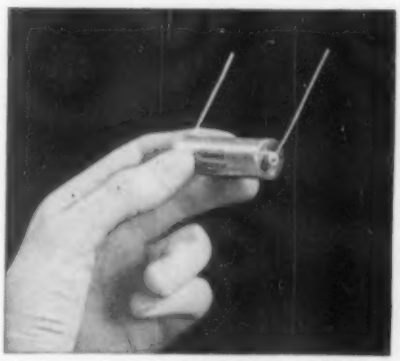
These subminiature metal-clad tubular capacitors with right angle leads are new additions to General Electric's subminiature line. The leads are welded to the silicone bushing stud at right angles rather than axially.

Especially suitable for printed circuit applications, the dimension between leads can be determined accurately for each case size required with assurance that every metal-clad tubular received will be within close specified manufacturing tolerances.

Because the leads do not have to be bent during assembly, there is less chance of breakage and leakage. The welded "right angle" leads will withstand the same rigorous shock, vibration and pull requirements as the axial leads.

These right angle lead capacitors are available in a full range of ratings for 85° C and 125° C operation.

Check "B" in coupon to receive GEC-987A for further information on this new line.



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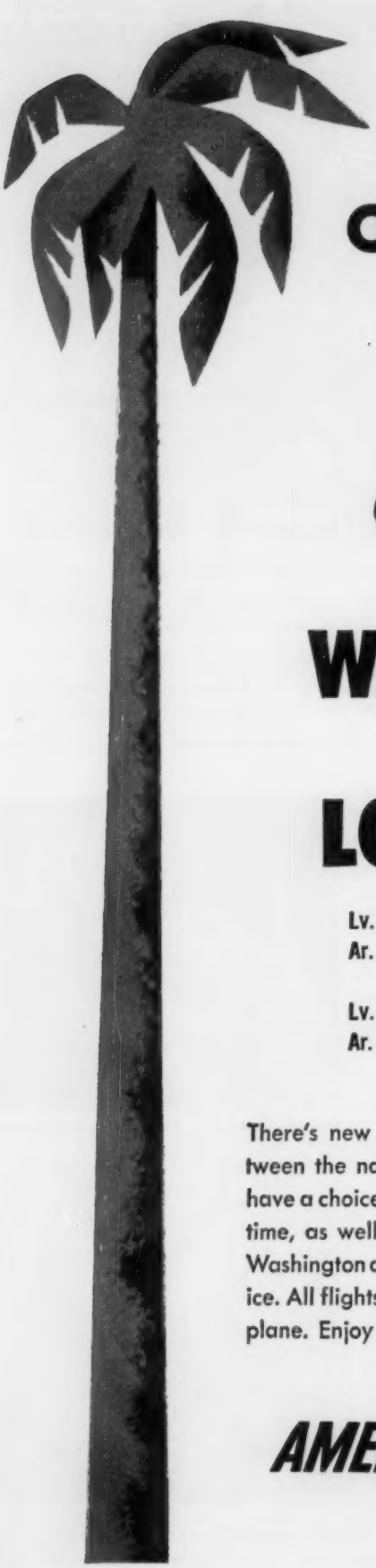
- ☐ "B" Subminiature Metal-clad Capacitors, GEC-987A
- ☐ "C" Hydraulic Constant Speed Drive, GEA-5979

Name..... Position.....

Company..... Project.....

City..... Zone..... State.....



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tion a number of long-range, positive programs aimed at "training the people whom we can retain and retaining the people whom we train."

▶ **Quarterly Surveys**—One phase of the attack on the reenlistment program is a series of quarterly surveys on airmens' reenlistment intentions. These normally reach 5% of the total airman population in each go-around. From these, planners have been able to determine the factors that appear to make Air Force life attractive or unattractive, and they thus open up fields for exploitation to make the reenlistment percentage go up.

An interesting point the surveys have brought to light is that those with more education are less likely to enlist, and those who are married or have dependents, who are from a rural background and come from the southeast and southwest sections of the country are more likely to enlist.

However, "it is doubtful if the manpower pool will ever be large enough so that technical training can be offered, for example, only to airmen without college, who are married and from rural backgrounds," an Air Force study wryly reports.

▶ **A Step Up**—One fertile point the surveys have uncovered: The airmen who tend to reenlist are those for whom the Air Force represents a step up both socially and economically. The meaning of this for USAF planners is that the Air Force ought to be made a step for a greater percentage of the population.

This would suggest more pay, better housing, greater prestige among civilian, to name a few approaches.

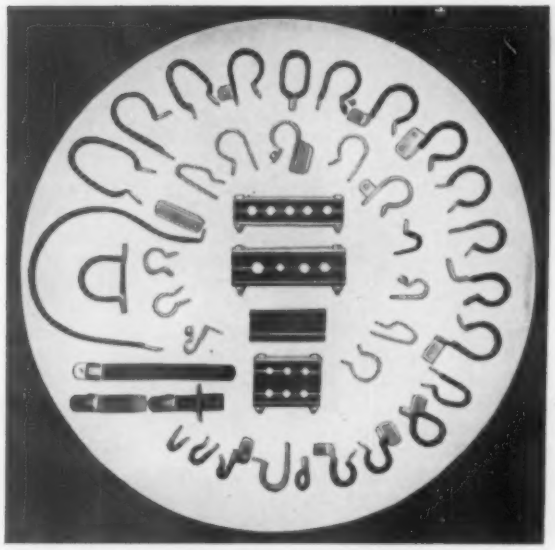
A good deal of Air Force's manpower problem is strictly not in its own hands. It calls for public and congressional awareness of the situation and the need. There is a great need to establish the Air Force—and the other military services—as a way of life (career) early in an individual's life. This would appear to be a long-term educational project reaching into every home and school.

However, there are a number of actions USAF itself is taking which could bear early fruit.

▶ **Re-Up Branch**—A Reenlistment Branch has been set up. This is the centralized Air Staff organization to deal with the problem. Under its wing, there has been set up a Packaged Program for Reenlistment, which deals with the various factors that operate on the morale of the airman, and are considered largely instrumental in whether he stays in the service or goes. The package suggests reenlistment procedures and presents plans that are in effect at various commands and bases.

Field Management teams have been set up, which will have visited all 149 Zone of the Interior bases by the end

Cost Saving Ideas...



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of this month and will then start a tour of USAF's overseas establishment.

There are groups gathering data, monitoring studies, making analyses, using public information media to help in the task of "retaining the trained."

► **NCO Prestige Improvement**—Air Force recognizes that it is operating now in a "buyer's market," and it has taken strong steps to reduce or remove the cause of many airmen gripes, as they have come to light in its various surveys.

One major action is its Noncommissioned Officer Prestige Improvement Program. "We hope to make the Master Sergeant the real kingpin the Navy CPO is," says Gen. Carmichael. But the lower noncom grades are not neglected, for it is hoped to increase the prestige of the NCO in general so that all young airmen will aspire to attain that status and thus become career men.

As part of this program, NCOs now have the responsibility for many jobs which formerly fell to officers. NCO academies and "prep schools" have been set up. At some bases, Airmen Councils, composed of NCOs, have been set up, which meet periodically and forward recommendations to the base commander on various organizational problems and activities.

In one major command, evaluation reports prepared by senior NCOs with regard to personnel under their supervision are considered by a promotion board of five senior NCOs in each squadron. Recommendations of the promotion boards are generally followed by the base commander.

Other prestige-enhancement actions include elimination of menial details, the privilege of check-cashing on the base without an officer's endorsement, establishment of separate messes, clubs, and sleeping quarters, no restriction on travel distance during off-duty hours, awarding of cross-country flights to deserving personnel, as available.

► **Power of the Woman**—The airman's wife fits in the reenlistment picture, too, and Air Force is making every effort to see that she is on USAF's side.

Assistance is offered on change of station, welcoming committees meet her at the new station, evening commissary hours are arranged so she can shop with her husband, periodic "open house" is held at various stations to show her the importance of her husband's job, and the opportunity is presented for community life and social gatherings at most bases. There are NCO Wives Councils and NCO Wives Clubs, which sponsor base nurseries and child care centers, among their other activities.

Air Force's concern with its personnel's family problems extends to its policy on interracial marriages. Airmen who have married interracially are assigned to bases in states that have no legal restrictions to such marriages.

By centralizing its control of 7-level (skilled) assignments, Air Force is able to plan personnel moves far enough in advance to give the airman sufficient time to wind up personal business at his old station and to arrange concurrent travel with his family.

To a much greater extent than formerly, airmen are able to attend technical schools of their choice and to choose the ZI or overseas base at which they would like to be stationed.

Educational opportunities within the Air Force are being emphasized.

► **Pay and Fringe Benefits**—Frequent gripes are heard about the lack of adequate housing for married airmen, and about "fringe benefits," such as medical care for dependents. These are all fields in which Air Force is looking for improvement.

Of course, higher pay would please everybody, but USAF must operate within its budget. Planners are considering a system of "selective raises," in the form of higher reenlistment bonuses for those whose specialties are most needed.

However, the case for a general increase is strong. Since 1939, the average airman's pay has gone up 110%, the average officer's 59%. In this time, the cost of living has jumped 200% and the average wage for labor 315%.

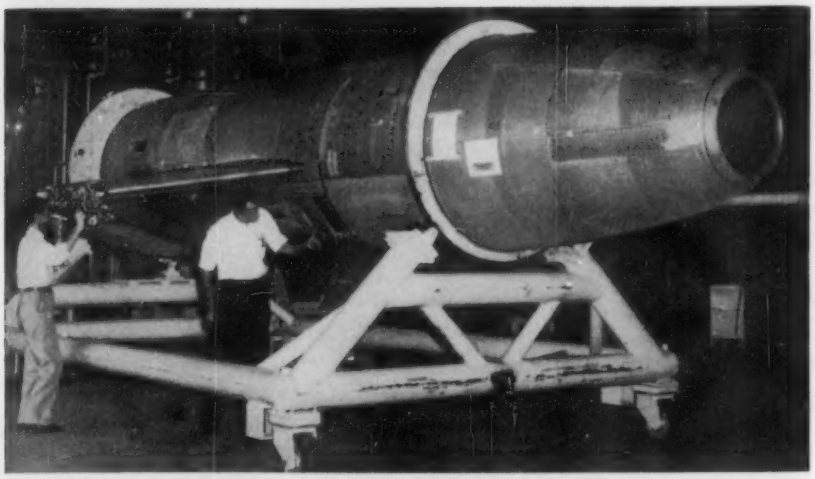
The President has asked Congress for an increase in pay rates and allowances. In addition, he calls for a "dislocation" allowance for military personnel with dependents who are ordered to a new permanent duty station. He asks for more housing, a better deal in medical care for dependents, an increase in travel allowances, and better pay for those engaged in hazardous duties.

► **Insecurity About Security**—One of the strong points that military service has to offer, Air Force's surveys show, is the liberal retirement policy. However, there is a "feeling of insecurity about security," Air Force says. There is the feeling that Congress gives and Congress can take away. Military people have seen how political pressures have been directed against commissary privileges, for instance.

Manpower planners in the Pentagon believe they must make a firm stand on this if they are to keep their needed personnel. Whatever fringe and retirement benefits military people now have they must keep, and Congress must make it clear that these are permanent, Air Force spokesmen say.

► **No Draft for AF**—Although the military manpower program proposed by the Administration calls for a drop to 2,815,000 (including a somewhat larger Air Force of 975,900) by June 1956, from the present levels of 3,218,000 and 961,000, in the absence of any immediate emergency a draft will still be required to fill the ranks.

However, Air Force, in company with the Navy, steadfastly maintains it must have four-year volunteers, not draftees, if it is to maintain its standard of "quality, not quantity." This is the job of the Reenlistment Branch. The next few years will tell how successful its program has been.



Regulus Missile Gets Cleanup

Chance Vought Regulus surface-to-surface missile is rotated in this rollover jig, prior to installation of its turbojet, to dislodge tiny bits of scrap metal which wedge in out-of-the-way places during assembly. A small power drill motor turns the Regulus like a turkey on a spit, dumping the waste out. About a handful is collected from each missile, the company states. Now under study is a vibrator to shake scrap loose.

Industrial Manpower

The production manpower situation in our airframe and allied industries

Building Boeing airplanes is a nation-wide project

America's global jet bombers—B-52s like the one shown above—are rolling off Boeing's production lines in steady numbers. Although this B-52 production is centered in Seattle, it incorporates the efforts of businesses and workers located from coast to coast, and from Canada to Mexico.

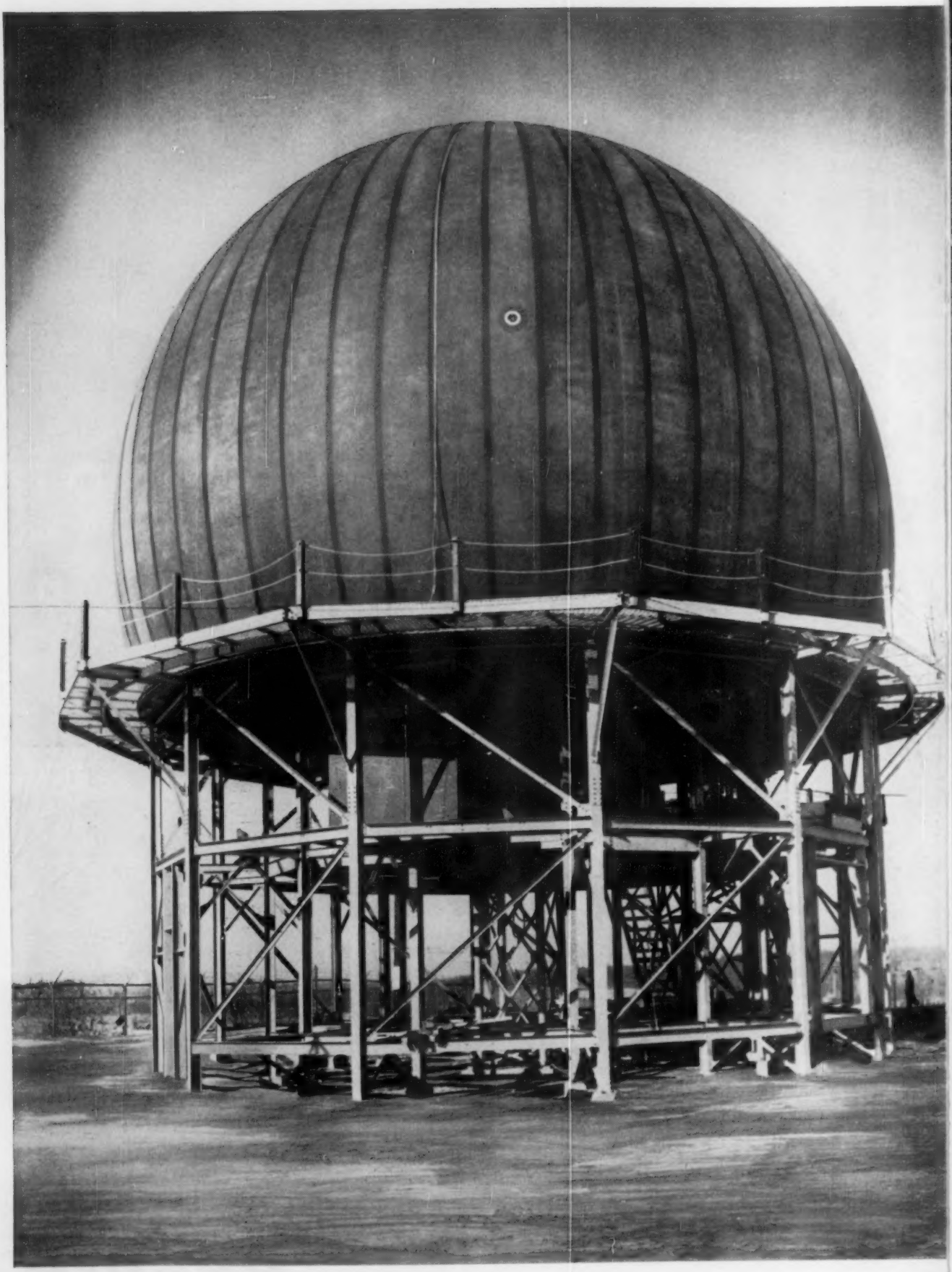
At latest count, more than 5,000 firms were supplying material, equipment or service for aircraft built by Boeing's Seattle Division. Of these, some 4,000 are small businesses having 500 employees or less.

Similar emphasis on subcontracting is the rule at Boeing's Wichita Division. Here Boeing builds the Strategic Air Command's front-line nuclear weapons carrier, the six-jet B-47, and is tooling up for B-52 second-source production. No fewer than 3,588 individual companies, more than 75% of them small businesses, share the work of this Division.

Out of every Air Force dollar contracted to Boeing, approximately 65 cents is passed on by Boeing to its subcontractors and suppliers. The remainder—about 35 cents out of each dollar—is retained by Boeing to cover all items in connection with its own in-plant operations. Boeing airplanes are truly nation-wide projects.

Maintaining a coast-to-coast subcontracting and supply network is a vital force in the nation's defense program. It assures a broad base for the production of aircraft needed for the foreseeable future. And, in time of emergency, it would provide trained, equipped and experienced supply sources capable of rapid expansion.

BOEING



The radar tower that *almost* builds itself!

You will find so many of these radar locations so far from civilization, that the question comes easily to mind: how do they ever do it in those inaccessible places?

Radar is complex. The equipment is not always easy to handle. Large construction crews and giant cranes are almost always needed.

"... Up by their own bootstraps"

A way had to be found, "to lift these radar towers up by their own bootstraps" in the far away, difficult places. No large crews. No great lifting gear.

Bendix* Radio engineers came up with the way to do it. These towers, as big and as intricate and complicated as they are, were ingeniously organized into almost "do it yourself" kits.

Each part is marked and numbered. Circuits are grouped and coded. Holes are drilled exactly. Beams fit precisely.

Working from the Bendix master plan, using the great leverage of the simple Gantry crane, small crews now put these towers up and into operation with a minimum amount of apparatus even under extreme conditions of turbulence, heat and cold.

This is just another indication of the extra "thinking through" that Bendix gives to any engineering problem . . . from the drawing board, through design and development, on up to the final (and often unusual) installation requirements.

Other radar

In other fields of radar, Bendix also makes both X-band and C-band airborne radar; the SPN-8, first successful aircraft carrier controlled approach radar (with gyro stabilized antenna); and the MPN-5, mobile radar unit with Moving Target Indicator scope, that clears up all ground clutter.

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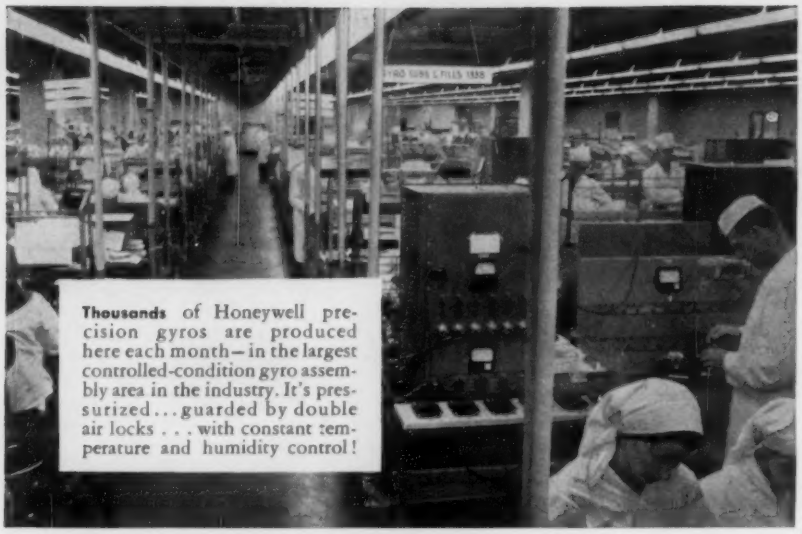


Thousands of Honeywell precision gyros are produced here each month—in the largest controlled-condition gyro assembly area in the industry. It's pressurized...guarded by double air locks . . . with constant temperature and humidity control!

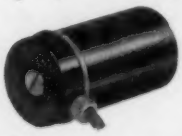
The new Honeywell HIG-4 Gyro — mass produced with precision accuracy

AN OUTSTANDING ADDITION to the Honeywell *Hermetic Integrating Gyro* "family" is the new HIG-4. The most accurate of the miniature gyros, it's ideal for such applications as aircraft and missile stabilization and fire control systems.

The HIG-4 is readily available for your needs. With test and production facilities unequalled in the industry, Honeywell is tooled to produce thousands of *precision* gyros a month. They're *specialists* in the gyro field!

The specifications on the HIG-4 are fully detailed below. For further information, and for information on the full Honeywell gyro line, write Honeywell Aero Division, Dept. AW-3-50, Minneapolis 13, Minnesota.

Specifications of the new Honeywell HIG-4



Motor Excitation: Voltage—9.5 volts, 3 phase. Current .37 amps. Frequency 400 cps.

Synchronous Speed: 12,000 rpm.

Angular Momentum: 2 x 10^4gm-cm^2/sec.

Acceleration Time: 15 seconds maximum.

Pick-Off Sensitivity: 25 mv/mr with 100 ma. excitation at 400 cps.

Maximum Rate: Up to 2.5 radians/sec.

Rate Threshold: Better than ¼ degree per hour.

Torque Generator Linearity Deviation: Better than ±1% to 1 radian/sec.; better than ±2% to 2 radians/sec.

Gimbal Travel: ±6°.

Gyro Transfer Function: $\frac{\text{Voltage Output}}{\text{Angle Input}}$ = 25 volts/radian.

Characteristic Time Constant: 2.1 milliseconds.

Heater Power: 350 watts (warm-up) 115V, 55 watts (running), 28 volts.

Warm-up Time: 5 minutes from —65° ambient temp.

Weight: 1.5 lb.

MINNEAPOLIS **Honeywell**

Aeronautical Division

112 OFFICES ACROSS THE NATION

presents one of the bright spots in the defense picture.

▶ **Level at 750,000**—The aircraft industry—the nation's largest employer—had about 775,000 on its payrolls at the end of the year, down from a 1954 peak of 830,000. Employment is expected to level at about 750,000.

This drop, on the average, is not the result of firings, but is due to natural attrition—death, retirement, change of job to another industry. It is a result of increased productivity as new machines and techniques are introduced, and of a higher position on the learning curve as the helter-skelter of the early post-Korea period gives way to a long-term period of procurement stability, with buying hovering around the $8-billion mark.

The manpower supply is adequate. And when a key production man leaves, although it may take two or three to do his job and it may involve going into overtime, the people and, if necessary, the money can be supplied. It isn't like the loss of a scientist, industry spokesmen point out—you can't replace one trained engineer with three junior draftsmen.

▶ **Draft No Problem**—For this reason, the draft has not hurt industrial production. As a matter of fact, all industry asked for only 17,000 occupational deferments last year and 25,000 in 1953 (agriculture had 90,000 deferments in 1954). Figures on the aircraft industry's deferments are not available.

If there must be selective service, aircraft industry spokesman say, all they ask is "truly selective service." They point to Secretary of State John Foster Dulles' statement that manpower is not the true measure of military strength. Technological advances have made the manpower cuts (proposed in the Administration's new program) possible, Dulles has said.

Allison Gets New Jet, Turboprop Contracts

Jet engine contracts totalling $3,582,415 have been awarded Allison Division, General Motors Corp., by Air Materiel Command, Department of Commerce contract synopsis disclosed. The contracts call for 176 engines.

An additional award to Allison for $120,900 for a turboprop engine also was listed.

An order for 149 reciprocating engines was announced for Continental Motors. This contract is valued at $476,140, including special tools and ground handling equipment.

Other major contracts included:

Kollsman Instrument Corp., Elmhurst, N. Y., indicators, $1,915,822.

Curtiss-Wright Corp., Carlstadt, N. J., flight simulator, $450,000.

PAA
MORE GO BY AIR THAN BY SEA
For the first time in History, more travelers went overseas by plane in 1954 than by ship
NEW YORK, N. Y.—In the short space of about 25 years—far less time than it took steam to supplant sail on the oceans—the airplane has passed the ship in popularity for overseas travel. 1954 was the first year in which the number of passengers flying overseas exceeded those who sailed on the surface. More people than ever now fly

Again in 1954

Pan American's First

on the Skyways of the World!

Throughout the world, there are now 60 airlines flying in competition with Pan American World Airways . . . Many of these are government-owned monopolies . . . Yet Pan American, operating under the American private enterprise system, was chosen by more overseas passengers than any other airline, U.S. or foreign.

Across the Atlantic, thirteen airlines now offer both first class and tourist service. Yet *more trans-Atlantic passengers* chose Pan Am's service—both first class and tourist—than any other airline.

And once again in 1954, Pan American carried more passengers *than all other airlines combined:*

—across the Pacific
—to and from Alaska
—to and from Bermuda
—to and from San Juan

Between Hawaii and the Mainland, PAA was again chosen by more passengers—both first class and tourist—than any other airline.

To and from Latin America, Pan American carried more passengers than any other airline. 'Round South America (up one coast and down the other), Pan American World Airways and its 50%-owned affiliate, Panagra, carried more passengers than in any other year.

To and from Havana, Nassau and the U.S.A., Pan American carried more passengers than any other airline flying to these islands. Pan American, the only round-the-world airline, completed its 2,075th scheduled, round-the-world flight during 1954.

During 1954 Pan American made foreign travel possible for millions by pioneering the original, nationwide "Pay-Later" Plan. Since last May, over 7,000 people have invested in "Pay-Later" travel.

In December, Pan American began the only NON-STOP service to both LONDON and PARIS at no extra cost . . . in its exclusive super-powered *Super Stratocruisers.*

In 1954, Pan American's world-wide Clipper* Cargo volume increased 17%. Across the Atlantic alone, the increase was 19%.

COMING IN 1955

New, Douglas-built "Super-7" Clippers—fastest long-range aircraft in overseas service—will be delivered in 1955. Pan American was first to order these super Clippers. They mean even better Pan American service.

*Trade-Mark, Reg. U. S. Pat. Off.

The Rainbow

to all Europe. First in popularity among all trans-Atlantic air tourist services!

The votes are in and the votes have been counted:

In 1954 more people chose Pan American's Tourist service, *The Rainbow,* than that of any other airline . . . U.S. or foreign! In fact, *The Rainbow* shows a 53% increase over 1953!

The Rainbow gives **6** extra values:

1. New, long-range "Super-6" Clippers.

2. Hot meals prepared in the same spotless kitchens which prepare the meals served on Pan American's First Class services.

3. Many NON-STOP flights to London and Paris.

4. Direct service from New York, Boston, Philadelphia, Detroit and Chicago to more cities in Europe than any other airline . . . *no change of plane.*

5. More convenient overnight schedules . . . and your choice of 5 routes—via Shannon, Glasgow, London, Paris or Lisbon.

6. The veteran flight crews and scientific flight procedure which have earned for Pan American its reputation as the World's Most Experienced Airline.

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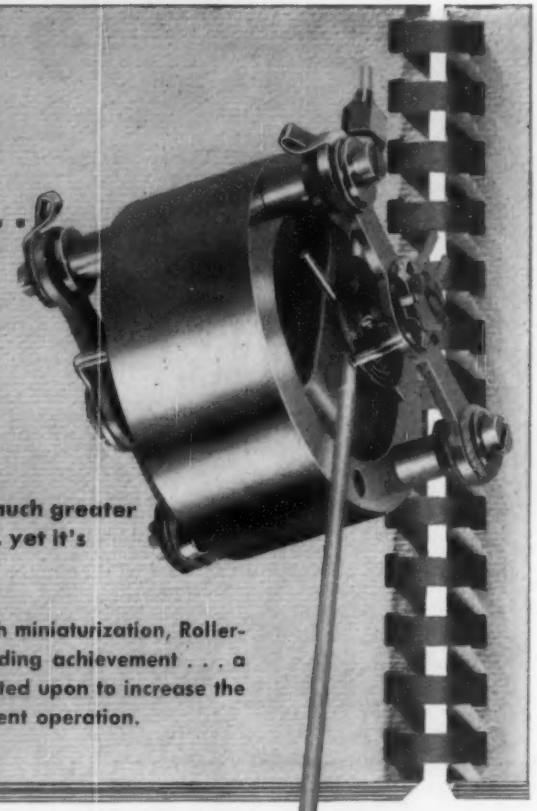
WORLD'S MOST EXPERIENCED AIRLINE

This

is just 1/2 the story...



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IAS Summaries

More than 80 presentations on the entire field of aeronautics featured the annual meeting of the Institute of the Aeronautical Sciences this year. From this large group, AVIATION WEEK selected representative summaries for publication.

This is the final installment of the series that began in the issue of Feb. 14. Requests for reprints of the papers should be directed to the Institute of the Aeronautical Sciences, 2 East 64th Street, New York City.

Air Transport

▶Direct Use of Rotating-Beam Ceilometer and Transmissometer in the Reporting of Ceiling and Visibility—R. C. Wanta, Meteorologist in Charge, Weather Bureau Airport Station, MacArthur Field.

The development and characteristics of the rotating-beam ceilometer and the transmissometer are described briefly. Preliminary experiments with the new instruments by the Weather Bureau at Silver Hill, Md. and at Washington National Airport are summarized.

▶A Flight Investigation of the Performance of Low-Ceiling-Visibility-Measuring Equipment—R. P. Snodgrass, Chief Engrg. Test Pilot, Sperry Gyroscope Co.

The Air Navigation Development Board in cooperation with the United States Weather Bureau has conducted a flight test program to evaluate operationally the transmissometer-ceilometer system of measuring low-ceiling/visibility weather with respect to what pilots see from the cockpit during actual weather ILS approaches.

▶A Review of High-Altitude Cabin Pressurization Design Criteria as Related to Future Transport Operations—L. M. Hitchcock, Staff Engr.—Struct., Boeing Airplane Co.

The problems associated with high altitude flight for transports currently being designed and planned for commercial operation are presented. Methods of obtaining reliability and safety of pressurized cabins for cases involving fatigue or other damage are outlined.

▶Design Considerations for Turboprop-Powered Cargo Aircraft—Winfield H. Arata, Jr., Prelim. Design Gr. Engr., Lockheed Aircraft Corp.

The purpose of this paper is to discuss some of the design considerations and economic aspects of operating commercial turboprop cargo aircraft.

The presentation is divided into two primary sections. First, cargo loading and cargo handling problems related to airframe design are analyzed. Particular attention is given to aircraft whose cargo loads will approach 50,000 lb.

The second part of this paper investigates the effect of turboprop engines on the operating costs of cargo airplanes. In particular, the direct operating costs of three different airplanes over the Los Angeles-Chicago route are presented. Detail factors in the ATA cost formulas are related to the total direct operating costs for each model.

Flight Safety

(In Cooperation with The Daniel and Florence Guggenheim Aviation Safety Center at Cornell University)

▶Escape from Highspeed Aircraft.—Richard H. Frost, Vice-President, Stanley Aviation Corp.

A brief review is presented of the evolution of emergency escape devices for high-speed aircraft. The original German and English developments which led to the basic U. S. Navy ejection seat are described and the fundamental research done by the U. S. Air Force is outlined.

▶Design Safety Aspects of the Boeing 707 Jet Transport.—E. W. Norris, Airworthiness Engr., Boeing Airplane Co.

Basic design safety philosophy of the Boeing 707 jet transport is described. Methods of analyzing and utilizing operating experience from military and civil sources are enumerated. Reliability analyses used to establish the probability of hazardous failures are discussed. Provisions are then made to minimize the consequences of remaining possible failures.

Flight Propulsion

▶Before Afterburner.—Frank F. Rand, Jr., Supvr., Design and Evaluation, Small Aircraft Engine Dept., General Electric Co.

The objective of the paper is to compare the performance of a basic 1,500F engine burning to stoichiometric upstream of the turbine to one burning to stoichiometric in an afterburner.

Calculators were performed with reasonable efficiencies at altitudes of 20,000, 40,000, 60,000, and 80,000 ft. over a range of flight Mach numbers .50 to 2.0. Single point data for pressure ratios of 4 thru 8 were used to select the design point.

At altitudes from 20,000 to 80,000 ft. the basis turbojet engine burning to stoichiometric upstream of the turbine was superior in specific fuel consumption and net thrust to the engine burning to stoichiometric in an afterburner.

Helicopter Dynamics

(In Cooperation with the American Helicopter Society)

▶Notes on the Effect of Extreme Operating Conditions on Helicopter Blade Flapping.—Robert J. Tapscott and F. B. Gustafson, Aero. Research Scientists, Langley Aero. Lab., NACA.

As compared with more-conventional types, blade-fuselage clearance for higher-performance, higher-speed helicopters is more difficult both to provide and to estimate or study. Accordingly, as a step towards clarifying the problems involved, this paper endeavors to summarize the present stage of knowledge.

Jato for Aircraft

(In Cooperation with the American Rocket Society)

▶Zero-Length Launch for Matador.—C. J. Libby, The Glenn L. Martin Co.

Evolution of zero-length launch technique for the Air Force TM-61 Matador, which resulted in the world's smallest airport for a tactical bombardment missile, is described in this paper. It also describes the design problems encountered and solved, and in addition gives some historical data on the testing performed.

Supplementing the paper is a short motion picture showing some of the early zero-length launch tests at Aberdeen Proving Ground, together with recent shots of Matador launchings, including inflight and terminal dive pictures.

Connie Family Brings in More Than $1 Billion

More than $1 billion in orders have been garnered by Lockheed Aircraft Corp. as a result of steady development of its original Constellation transport (No. 3, left) which first flew in 1943. This cluster of transports at Burbank, Calif., typifies some of the resulting Super Connie versions. No. 1 (foreground) is President Eisenhower's personal transport, Columbine 3; No. 2 is a Navy-MATS R7V-1; No. 3 is now a "flying laboratory"; No. 4, Seaboard & Western Airfreighter; No. 5, Avianca (Colombia) transport; No. 6, USAF RC-121D radar early warning picket; No. 7, Navy WV-2 radar early warning picket and No. 8, R7V-2 turboprop-powered prototype. First Connie weighed 72,000 lb.; latest Super Connie weighs 150,000.

Stretch Forming Control Improved

- **New technique assures constant elongation.**
- **Material and machine variables minimized.**

By Irving Stone

Torrance, Calif.—A technique that promises new accuracy of control for consistent parts production in stretch-forming was demonstrated here in a first public showing to a group of about 250 representatives of airframe builders and allied activities in the aviation field.

Known as positive position forming, the process was perfected by Sheridan-Gray, Inc., a research and development division of stretch-press builder T. W. & C. B. Sheridan Co.

▶**What It Does**—The process is designed to provide a definite accurate relationship between the stretch form jaws and the die during the entire forming operation—a control not available on existing stretch-forming machines, according to Landon Gray, Sheridan-Gray's vice-president and general manager.

The part being formed is elongated by positive linear dimensional control only. Result is a constant and repetitive elongation according to a preset safe value. Effect of variables in the material is minimized, variables in the machine and operator are eliminated.

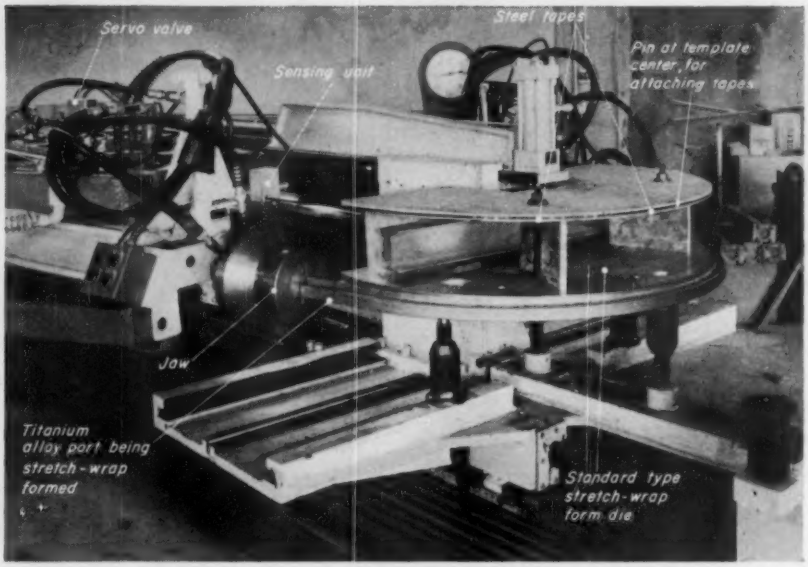
▶**Hurdles Overcome**—Gray sums up the new process this way:

"It is as big an improvement over the existing stretch-forming process as the latter was over hand-forming." Gray sees his positive position forming process as the solution for the majority of problems encountered in present-day stretch-forming.

These include nonrepetitive springback, operator error, lack of sensitivity of large-capacity machines when forming small cross-sectional parts, relative sliding of work on the die, inadequate control of elongation due to variations in dimensional and physical properties of the past, and variations in operating conditions (pump pressures, packing friction) of the machine's tension cylinders.

• **Basic target** is to incorporate the control in all Sheridan stretch-forming machines now operating in plants or to be built in the future.

• **Second objective** is to offer to the aircraft industry a control package to fit any make of stretch-press now operating. In most cases, adaption of the control would involve only a minor modification—changing the tension cylinder selector valve circuit to incorporate a hydraulic servo valve, addition of an operator's remote control servo transmitter and pickup unit, and servo amplifier.



SENSING TAPES feed into sensors near jaws of 20 ton Sheridan forming machine.

Price of the installation on a 20-ton Sheridan extrusion stretch-press would run about $8,750.

▶**Advantages Seen**—Positive position forming process is designed to:

• **Form extremely small** cross-sectional parts on high-tonnage stretch-forming machines. On existing machines the minimum satisfactory operating capacity (tension cylinder pull) is about 10% of maximum, Gray claims, whereas with positive position forming the value can be dropped to 1% of maximum.

This means that a 20-ton stretch-press (common size for extrusions) can be used for a wide variety of work, eliminating the need to put small parts on a small press.

• **Afford consistent elongation.** Because each part (for a particular run) is elongated the same amount without being adversely affected by the variables in the material and machine, the resulting springback is consistent, part-to-part, Gray says.

This means that the form die may be undercut to allow for springback, thus giving parts a consistent configuration. This, in turn, means that many times an aluminum alloy part can be run in the T-condition (hard) to eliminate the necessity of heat-treat and a second stretching operation.

Also, because elongation is consistent, part breakage due to excessive stretching is practically eliminated. The amount of hand-forming (after-forming)

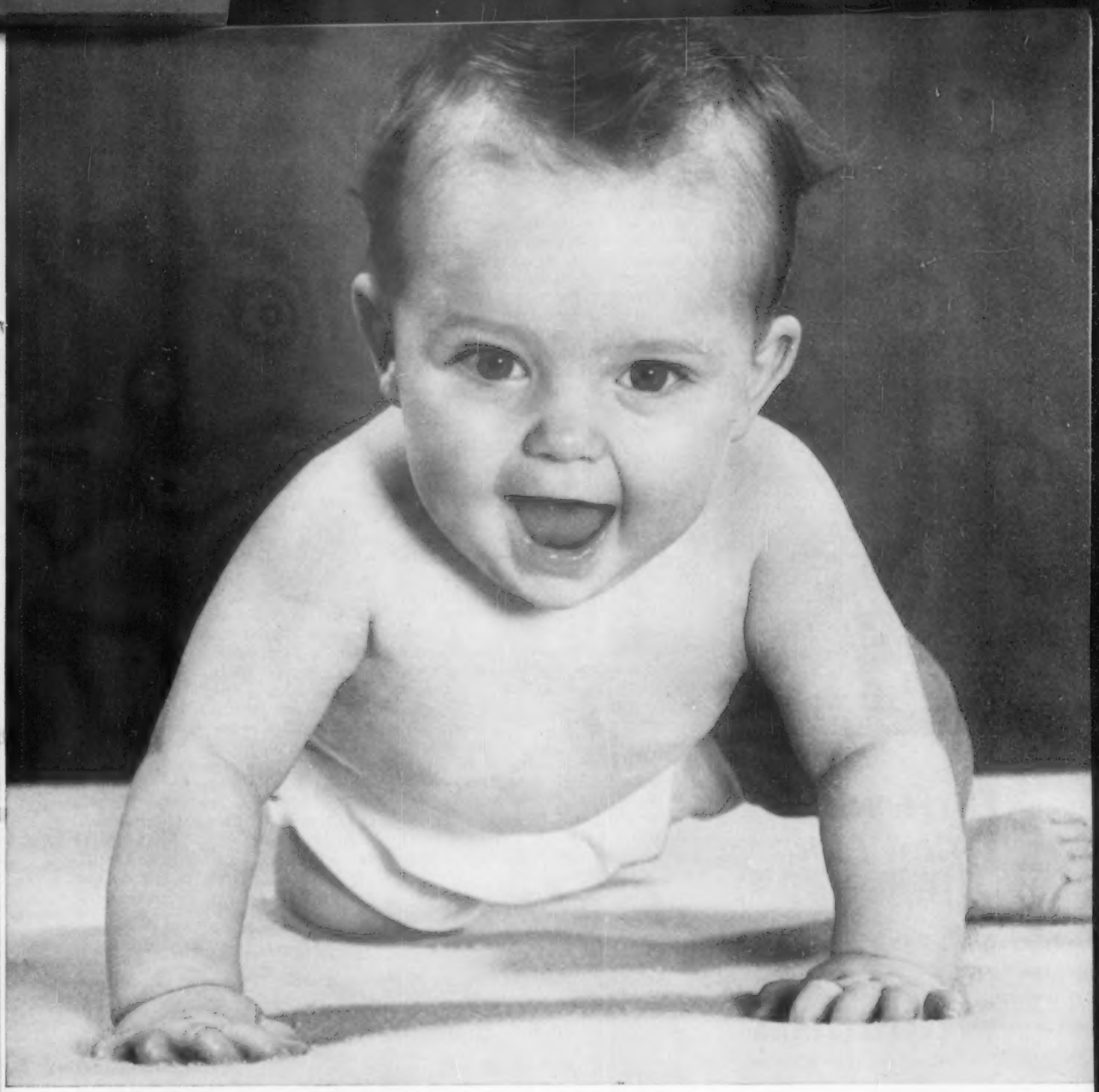
Highlights

Outline of the template of the part being formed is a predetermined, theoretical neutral axis (line between tension and compression in the part). Difference between perimeter of template and that of the outside of the finished part is equal to the desired percentage of elongation. Template is easily cut from plywood.

Sensing units are equipped with steel tapes attached to a pin located at center of template perimeter. Tapes progressively follow template contour during forming, transfer part's linear dimensions to sensing units.

Sensing units respond to any variation in tape length as it is wrapped around template. Signals transmitted through servo-amplifier to hydraulic servo-valves accurately control relative position of the jaws to the die.

Servo-amplifier also amplifies signals from the operator if he desires to supplement the template before, during, or after forming cycle is completed.



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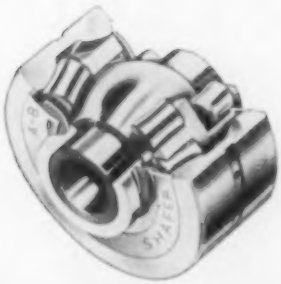

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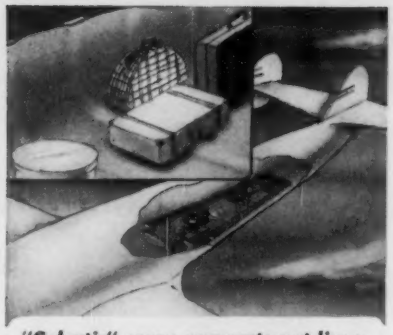

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is considerably reduced.

Another big advantage, Gray says, is that the constant elongation assures the design engineer that the structural characteristics shown by test for parts from a first run on the machine will be matched in the successive parts.

• **Reduce stock length,** because relative sliding is eliminated between stock and die during the forming operation. (This is insured by having sensing tapes tied to a centering pin on template.)

• **Reduce operator error.** Relationship between perimeters of die and template establishes the amount of elongation. Thus, a 100-in.-perimeter template would be used in conjunction with a die having a perimeter of 106 in., to give a 6% elongation. At the start of the stretch-forming, the material length between the jaws would be 100 in.

In this way, the tooling (template) controls the elongation—the operator has no control over it. On existing machines, elongation is controlled by operator-adjustment of hydraulic pressure, Gray points out. Also, at the completion of the wrapping cycle the pressure is increased for final set of the material. With positive position forming, this final stretch is not necessary.

▶ **Runs with Titanium Alloy**—Because of the small spread between yield and ultimate strengths of titanium alloy, it is very difficult to control elongation by control of cylinder pressure—variables in the hydraulic circuit and the part itself become very critical.

By controlling elongation dimensionally with positive position forming, the small spread between yield and ultimate is no factor, Gray says. Only consideration is the allowable elongation of the material.

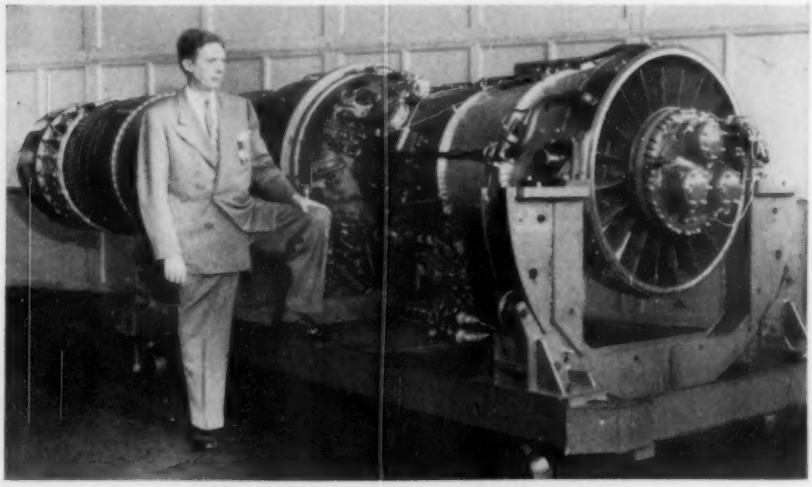
For example, Sheridan-Gray ran a series of titanium alloy (RC-130A) parts in conjunction with a major airframe manufacturer. These parts were .025-in. Z-sections about 1½ in. high with 1-in. legs and about 96 in. long—typical fuselage frames, in the afterburner area.

▶ **Results**—At the recommendation of the airframe manufacturer, a 10-min. cycle was established for stretch-forming to the 180-deg. bend. The template was calculated to produce a 4.6% elongation in the outer flange of the part, since the airframe manufacturer had specified 5% maximum elongation. Sheridan-Gray formed 19 pieces with very satisfactory results, it is reported.

The airframe manufacturer was able to form the titanium alloy parts only under laboratory conditions (with supervision by methods development personnel), it is said, but couldn't duplicate this in the shop under normal production conditions—which introduced factors of operator error, machine variations. Under the production conditions, part breakage was excessive.

▶ **Big Machine Study**—An engineering analysis is underway, aimed at putting the positive position forming control on the world's largest sheet press—a Sheridan 750-ton unit which will form 14-ft. by 20-ft. sheet. This press is now installed at the plant of a West Coast airframe manufacturer.

Companies represented at the recent demonstration of the positive position control included Boeing (Seattle), Convair (San Diego), Northrop, Douglas (all divisions), Lockheed (Burbank), Rohr, North American (Los Angeles and Columbus), Chance Vought, Mitsubishi Heavy Industries, Menasco Mfg., Lear, Rheem Mfg., Longren Aircraft, Doak Aircraft, Timm Industries, and many others.



P&W Ships Its 1,000th J57

Pratt & Whitney Aircraft General Manager William P. Gwinn looks at the 1,000th J57 turbojet built by the firm as the powerplant was being prepared for shipment from East Hartford, Conn. Delivery versions of the J57 are producing more than 11,000 lb. thrust without after burner (Aviation Week Feb. 28, p. 11).

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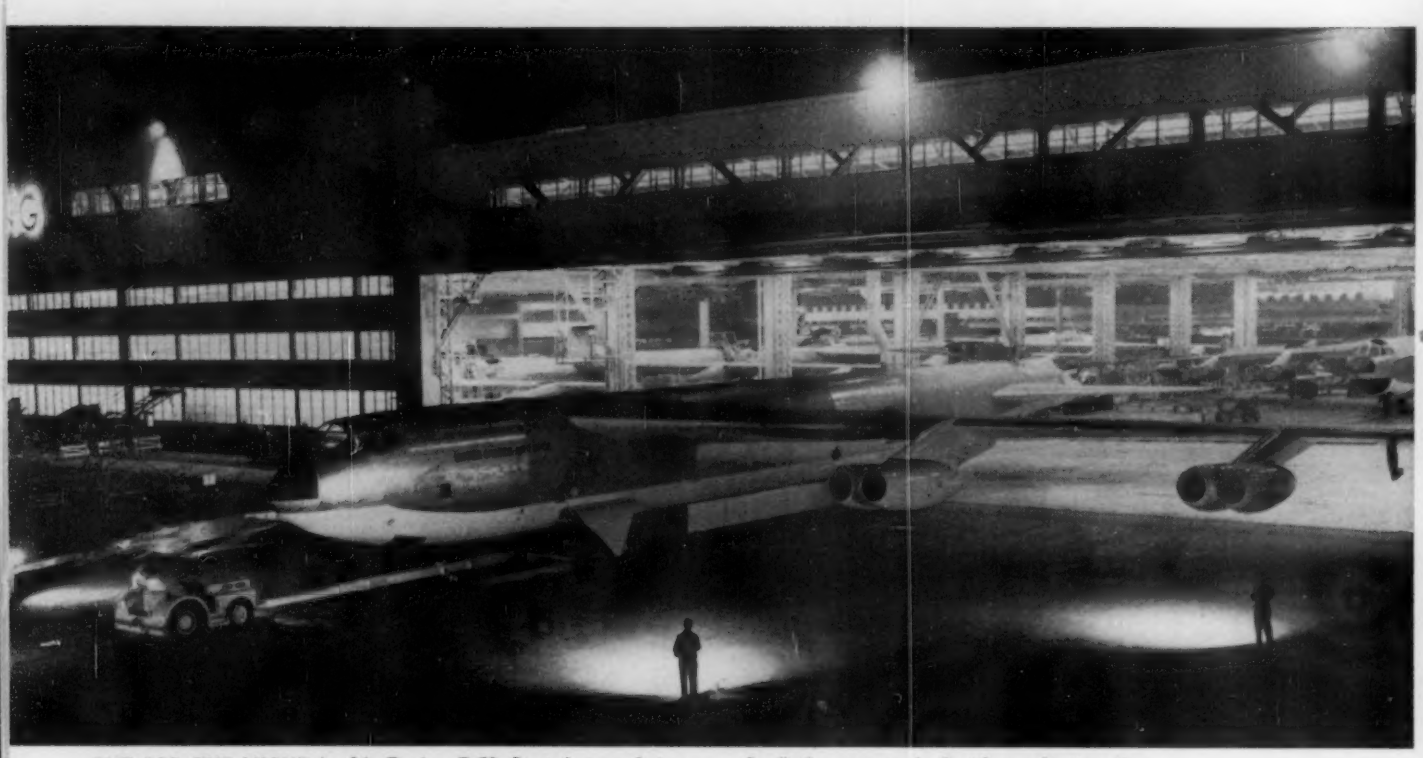
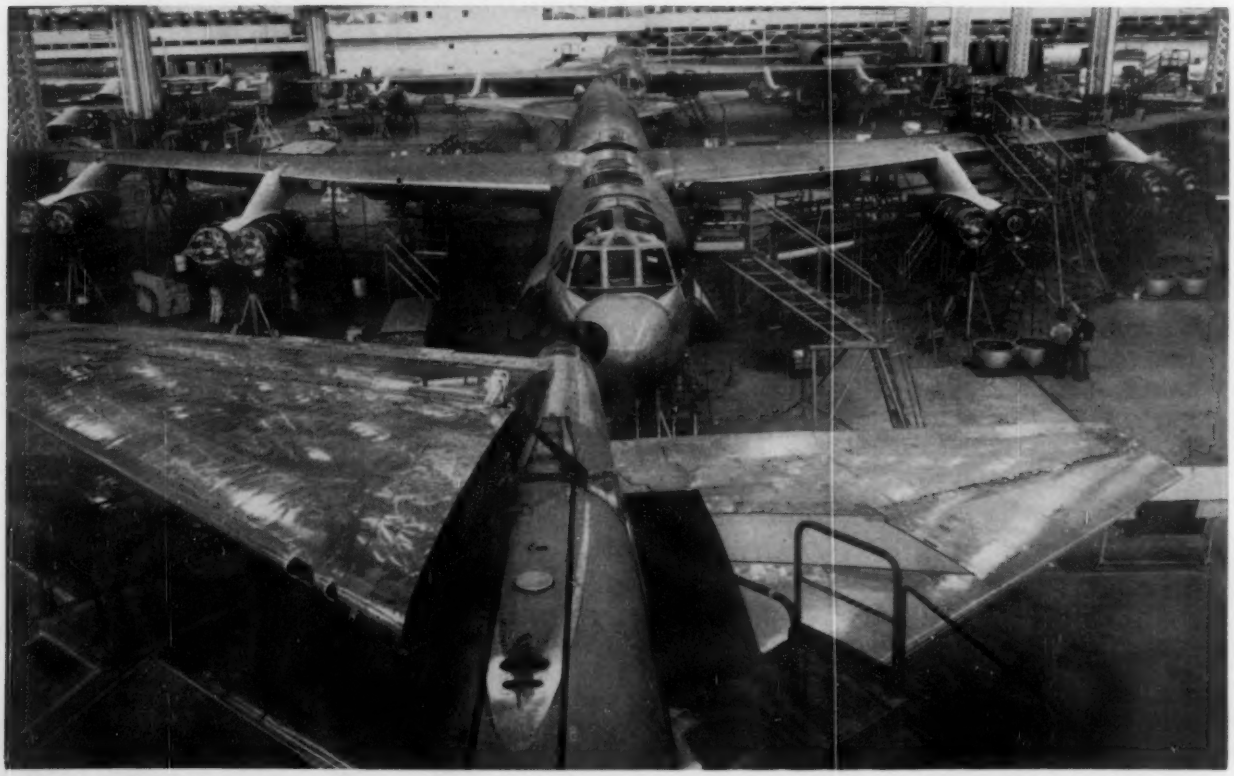


OUT FOR THE NIGHT is this Boeing B-52 Stratofortress being moved off the company's Seattle production line.

Boeing Says B-52s Are 'On Schedule'



THREE ON THE LINE: final assembly area at Boeing-Seattle shows three of the sonic bombers nearing completion and parts of at least six others. Tail turret of first plane reveals unusual shape.

• Boeing B-52 Stratofortress production, now concurrent at the Wichita, Kan. division and the Seattle main plant, is the largest portion of the company's reported two-billion-dollar backlog.

Boeing reports both plants "on schedule," answering a recent statement by Sen. Richard B. Russell, chairman of the Senate Armed Services Committee that B-52 production was slipping.

First deliveries to USAF of the eight-jet bomber will start later this spring; first unit to get the 600-mph. plus bomber will be SAC's 93rd Bomb Wing, Castle AFB, Merced, Calif.

▶ **In One Year**—First production B-52A rolled out one year ago, made its first flight Aug. 5. Production airplanes have come out of the huge doors at the Seattle plant at irregular intervals since then.

Some teething troubles, common to any new airplane, caused minor delays in flight test and elsewhere, says a company spokesman. But he emphasizes that the B-52 has been remarkably "bug-free," considering size and type.

Current practice is to fly production airplanes from Boeing Field, Seattle, to the new $10-million facility at Larson AFB, Moses Lake, Wash. Final installation of equipment and production flight test programs are conducted there. First B-52 was delivered on Feb. 25.

▶ **In Kansas**—The Wichita division has moved major components from jigs to final assembly, where space is shared with production of B-47 Stratojet.

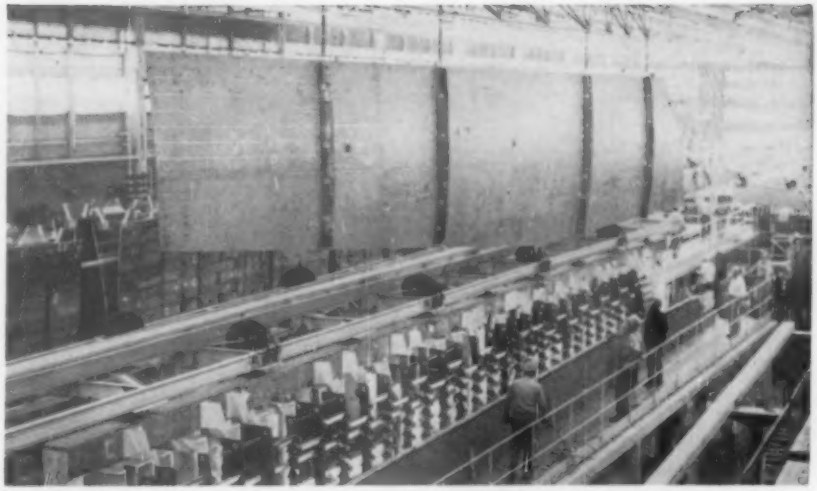
Some indication of the production capacity of Wichita was furnished last year when Boeing delivered the 1,000th Stratojet to be built at that plant.

Among these pictures are the first to be taken of Boeing's second-source production for the B-52.

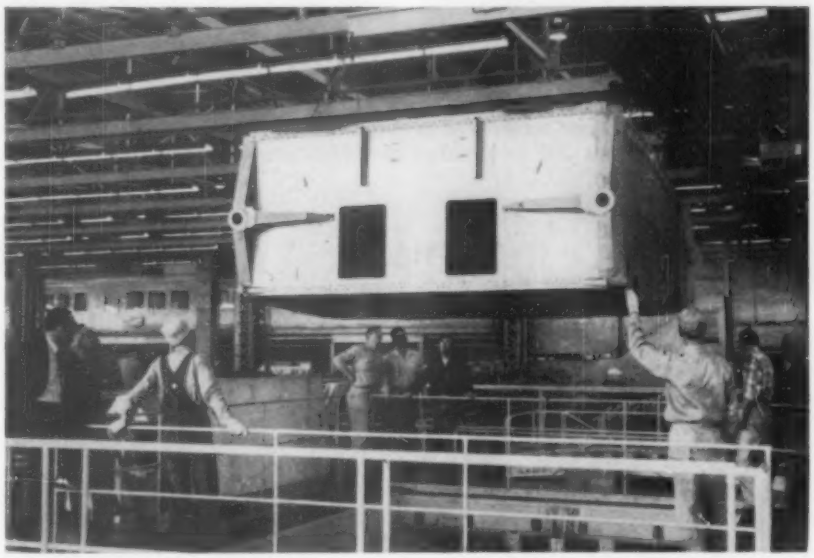
Latest specifications released by Air Force on the B-52 series rate the big bomber with a range of more than 6,000 mi., and state that Boeing Flying Boom aerial refueling equipment is standard. A crew of six flies the 350,000-lb. airplane.

Other specifications: Wingspan, 185 ft.; length, 156.5 ft.; height, 48.3 ft. Powerplants are eight P&WA J57-P-1 turbojets rated at 10,000 lb. thrust. Armament: four .50-cal. machine guns.

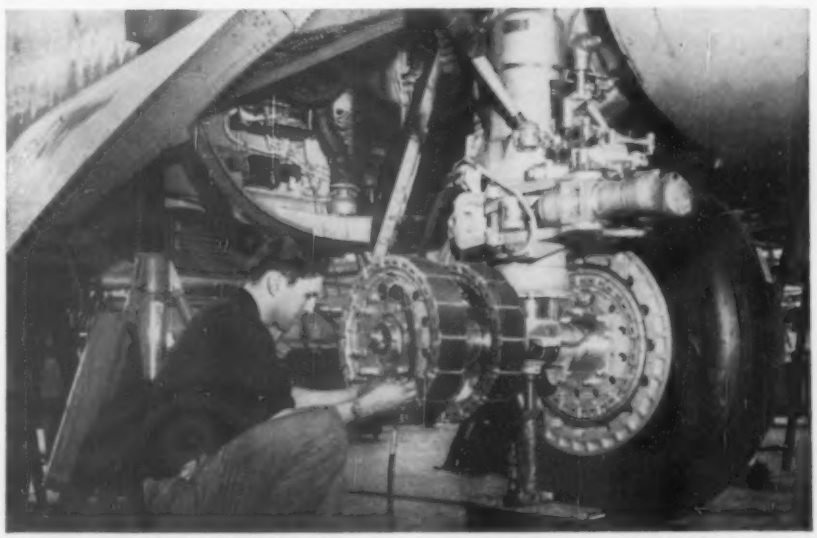
Boeing built an experimental XB-52, a service-test YB-52 and a limited group of B-52As. Current production models are split between B-52B and RB-52B. In addition, USAF sources list a contract for 50 B-52Ds.



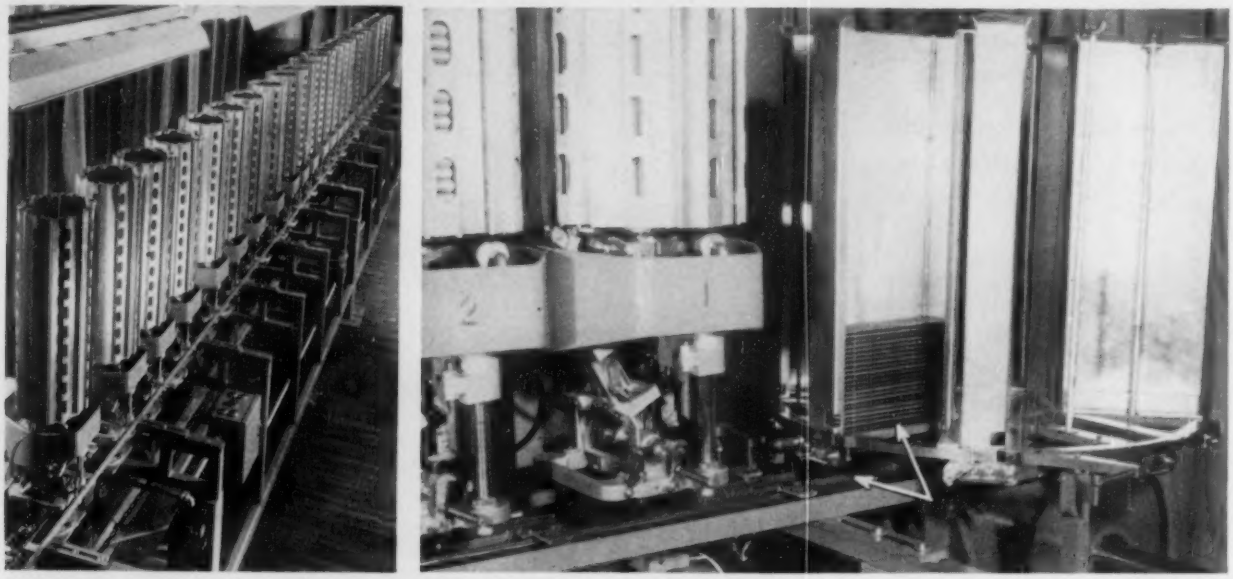
UPPER PANEL of B-52 wing is hoisted out of construction jig at Wichita.



CENTER SECTION of B-52 comes out of jig ready for final assembly at Wichita.



MAIN GEAR is built by Bendix, Cleveland Aircraft; tires, wheels and brakes by Goodrich.



AUTOFAB, new device for mechanized assembly of electronics, consists of a battery of placement heads (l.) each of which installs conventional components (fed from vertical magazines) in printed circuit boards which are magazine-fed to conveyor at end of line (r.).

Autofab Sparks Automation Race

By Philip Klass

"Autofab," General Mills' new machine for mechanized assembly of electronic equipment, has jumped into a leading competitive position within weeks after its public unveiling (AVIATION WEEK Feb. 21, p. 7).

Several TV-radio manufacturers have placed firm Autofab orders. Other companies, including firms in the avionics field, are negotiating for the machine. A General Mills spokesman says company names can not be divulged yet.

The first Autofab—capable of turning out printed circuit boards with 24 conventional components installed automatically at a rate of 20 boards per minute—has been delivered to International Business Machines Corp., where it will be used to build large digital computers for air defense. A comparable unit would cost approximately $90,000, with delivery quoted at six to eight months.

With firm orders under its belt, General Mills appears to have the jump on United Shoe Machinery Co. and Admiral Corp., which earlier developed mechanized assembly machines for placing conventional components in printed circuit boards.

Extent of industry interest in Autofab is evidenced by the report that all major TV-radio and computer makers have sent representatives to Minneapilis for a first-hand look at the General Mills machine.

▶ **Nearly Automatic Factory**—Autofab is the key unit of five associated machines now in various stages of development. Jointly they will prepare components, mount them on a printed board, dip solder the assembly, test all circuits and then give it a protective coating—all automatically.

Autofab itself consists of a battery of component attaching units (24 on the IBM model), each of which installs a single type of component. (The type of component installed at each station can be changed quickly and easily by substituting a new placement head.) Printed circuit boards, loaded in a master magazine, feed out on a conveyor under the line of attaching heads.

When the boards reach the proper position, the conveyor stops momentarily and all heads simultaneously install their components. The conveyor then starts up, advances the boards one station and the procedure is repeated.

One attaching head is required for each different component to be mounted. Each head is fed from an eight-magazine turret that rotates automatically when one magazine exhausts its components. This permits re-loading with new magazines without interrupting the line's operation.

Prior to delivering the first Autofab to IBM, General Mills began work on five more units that it expects to complete within six months.

▶ **Other Key Machines**—The associated machines, which will further mechanize the production of electronic assemblies, include:

• **Component preparation machine.** Conventional types of components dumped into this device's hopper will come out with their leads straightened, cut to size (with wrap-around sleeves on the leads if standoff-type mounting is desired) and loaded in magazines ready for installation on Autofabs. One such machine will be able to service at least five attaching heads, a General Mills spokesman says.

The first of five component preparation machines now under construction is completed and ready for delivery. Four more are nearly ready to go. Four of these five are designed to handle conventional tubular components, such as resistors and capacitors with one lead extending from each end. The fifth machine is for components such as pulse transformers, which have two leads on one end.

A component preparation machine can handle a small range of different size components without changing the setup. This requires only a quick change of face tool to take a new range of sizes. For instance, the device might

handle ¼, ½ and 1-watt resistors with the one face tool, 2 and 3-watt resistors with another.

• **Dip soldering machine.** This device, being built by General Mills to an IBM design, will automatically flux, dip solder and clean assemblies. The initial machine, scheduled for completion in about two months, will handle the output from three Autofab lines.

• **Automatic circuit tester.** Work on this device is in the development stage.

• **Automatic coating machines.** Work has not started on this device.

▶**Autofab Flexibility**—General Mills spokesmen emphasize the flexibility of the Autofab machine. The present design can be adjusted to accommodate printed boards with 2-10 inch lengths and widths. With minor changes, other size boards could be used.

The attaching heads are lightweight (25 lb.), interchangeable and can be located in any station position on the assembly line. The head can be pulled quickly by removing only two bolts.

Components can be mounted flat against the board, or standoff. The tapered wrap-around sleeves, an IBM-developed technique for stand-off mounting, give good mechanical connection between component leads and printed board prior to dip soldering. Components can be mounted at any angle on the board, and their leads can be crimped independently in any direction under the board. It is even possible for Autofab to install components with "bowed" leads in holes spaced closer together than the components body length.

▶**Variety Of Components**—Autofab is capable of installing all types of resistors, tubular or rectangular (mica) capacitors, tube sockets, pulse transformers, intermediate frequency cans (transformers) and insulated or uninsulated jumper wires. Polarized components, such as tiny diodes, also can be installed—with due respect for their polarization.

Although the IBM Autofab did not require mechanized installation of power transformers, they would present no problem, a General Mills spokesman says.

▶**What It Costs**—Although the cost of an Autofab will vary slightly with user requirements, General Mills has established the following approximate prices:

• **Ten-Head machine,** $50,000
• **Twenty-Head machine,** $81,000
• **Twenty-four-Head machine,** $90,000
• **Thirty-Head machine:** $104,000
• **Forty-Head machine:** $135,000

These prices include conveyor and printed-circuit board loading magazine. Delivery is quoted at six to eight months.

A component preparation machine, capable of servicing at least five placement heads, will sell for approximately $5,000. The automatic dip-soldering machine, able to service three Autofab lines, will sell for around $35,000.

▶**Inexpensive Start**—General Mills says a prospective Autofab user can start out on a modest scale by purchasing a five or 10-head line, even if the assemblies he wants to turn out require more than 10 components.

The secret is "recycling." Printed circuit boards could be run through a 10-head line, then reloaded in the magazine, the placement heads changed and the boards run through the line again where up to 10 new components could be installed. Changing over a 10-head line should take no more than an estimated 15-30 minutes.

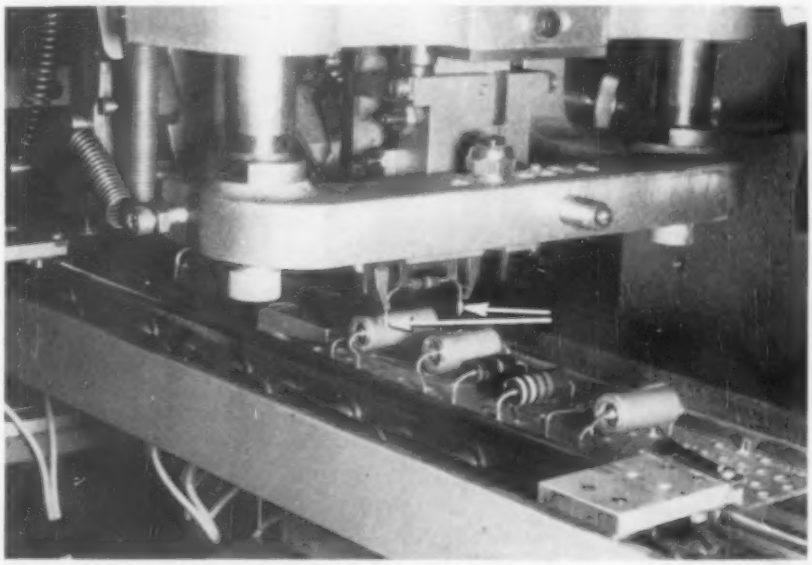
To enhance further the versatility of Autofab for small production runs, General Mills plans to develop multiple-component placement heads on a turret controlled from a punch card programmer. This would permit automatic changeover and recycling in a small line.

A company analysis indicates the present manual head change will be more economical than the projected multiple-head machines on a 24-head line if the production run exceeds 160 units.

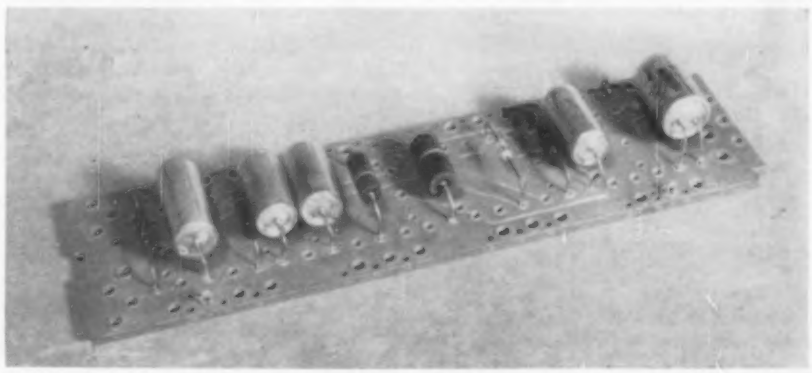
▶**How They Got In**—Readers who know General Mills as the world's biggest flour miller may be surprised at its entry into automation. Autofab was developed by the company's Mechanical Division, formed in the 1920s to develop automatic flour packaging machinery. During World War II, the division produced precision military instruments and computers.

Since the end of the war, the Mechanical Division and its engineering research and development department, have expanded their activities in the aviation and avionics field. The division currently builds the periscopic bombsight used in the B-47, and the ERD department does work in fire control, bomb guidance, microwaves and telemetering.

▶**SRI Influence?**—ERD is headed by Dr. Cledo Brunetti, who came to General Mills from Stanford Research Institute, where he was the associate director. At SRI, Brunetti was close to a USAF-sponsored program to study and develop techniques for mechanized assembly of electronic equipment. This



CLOSE-UP OF AUTOFAB placement head (top) shows tapered wrap-around on component leads (arrows) which permits stand-off type mounting on printed circuit boards shown below.



background, coupled with the Mechanical Division's experience in mechanization, resulted in launching the Autofab development.

Meanwhile, IBM had decided to develop a mechanized assembly machine to speed production of its air defense computers. When it learned that General Mills was working along similar lines and had a pilot model already built, IBM joined up and dropped its own development.

IBM engineers worked closely with General Mills in Autofab's design, and several IBM techniques are incorporated in the associated component preparation and dip soldering machines.

Autofab, coupled with the new ACF Industries automatic Tinkertoy factory that for the first time makes the Tinkertoy modules commercially available in large scale quantities should do much to spur industry action toward automation during 1955.

FILTER CENTER

▶**High-frequency Transistors Coming**—All major semiconductor producers reportedly are working on new intrinsic barrier-type transistors (P-N-I-P), invented by Bell Telephone Labs, which can be operated at frequencies of 250-500 mc., and theoretically up to 3,000 mc.

▶**Airtron-Hughes Aircraft Deal**—Airtron, Inc., maker of microwave components has signed a manufacturing licensing agreement with Hughes Aircraft Co., under which it will manufacture HAC-developed microwave ferrite elements such as attenuators, isolators, and modulators.

▶**Airplane Defined**—Newest definition of an airplane: "A large collection of complicated electronics which just barely flies." The source: David Packard, president Hewlett-Packard Co., speaking before a recent meeting of Stanford Research Institute associates.

▶**GE Cuts Transistor Prices**—Price reductions of 22% to 45% on its complete line of MIL-spec, hermetically sealed transistors has been announced by General Electric. GE attributes lower prices to company's new mechanized production facilities.

▶**How to Cut VOR Error**—New procedures for calibrating omni-bearing selectors used with Collins and Bendix VOR receivers reportedly reduce possible errors up to 600%. They are described in report prepared by Special Committee 61 of the Radio Technical Commission for Aeronautics. Copies (Paper 209-54/DO-62) may be obtained from the RTCA Secretariat for 25 cents. Address: Room 2036, Bldg. T-5, 16th St. & Constitution Ave., Washington 25, D. C. —PK

Avionic Literature

Recently announced bulletins and brochures of interest to persons in the avionics field include the following:

• **Oscillographic recording systems,** Series 150, available with two or four-channels, choice of six different plug-in preamplifiers. (6 pp.) Sanborn Company, Industrial division, 195 Mass. Ave., Cambridge 39, Mass.

• **Plastic wall chart,** lists 269 different types of RETMA "preferred values" of ½, 1 and 2-watt composition resistors, and 46 RETMA types of fixed composition capacitors. Chart includes resistor and capacitor color codes. Requests should be made on company letterhead to Stackpole Carbon Co., Electronic Components division, St. Marys, Pa.

• **Delay lines,** continuously variable, distributed-constant type. Data Sheet 54-81. Helipot Corp., Technical Information Service, South Pasadena, Calif.

• **Aircraft windshield heater control** system, using no electron tubes. Technical bulletin F-6563 describes circuitry and principles of operation. (2 pp.) Barber-Colman Co., Aircraft Controls division, Rockford, Ill.

• **Servo Corp. facilities** brochure, entitled "This Is Servo." (24 pp.) Company makes radio communication, navigation, direction finding equipment, infrared detectors, computers, optics. Company's address: 20-20 Jericho Turnpike, New Hyde Park, N. Y.

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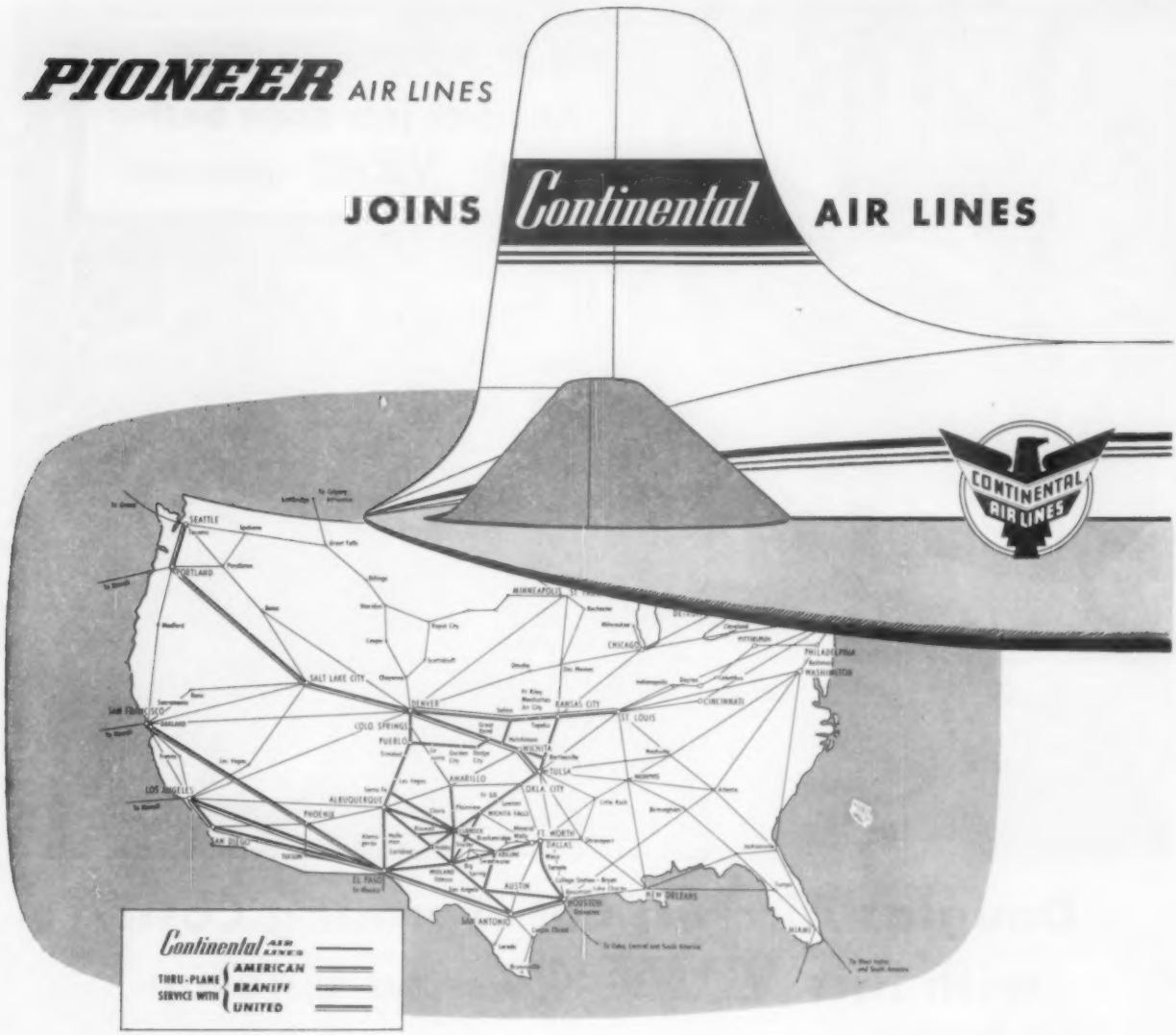

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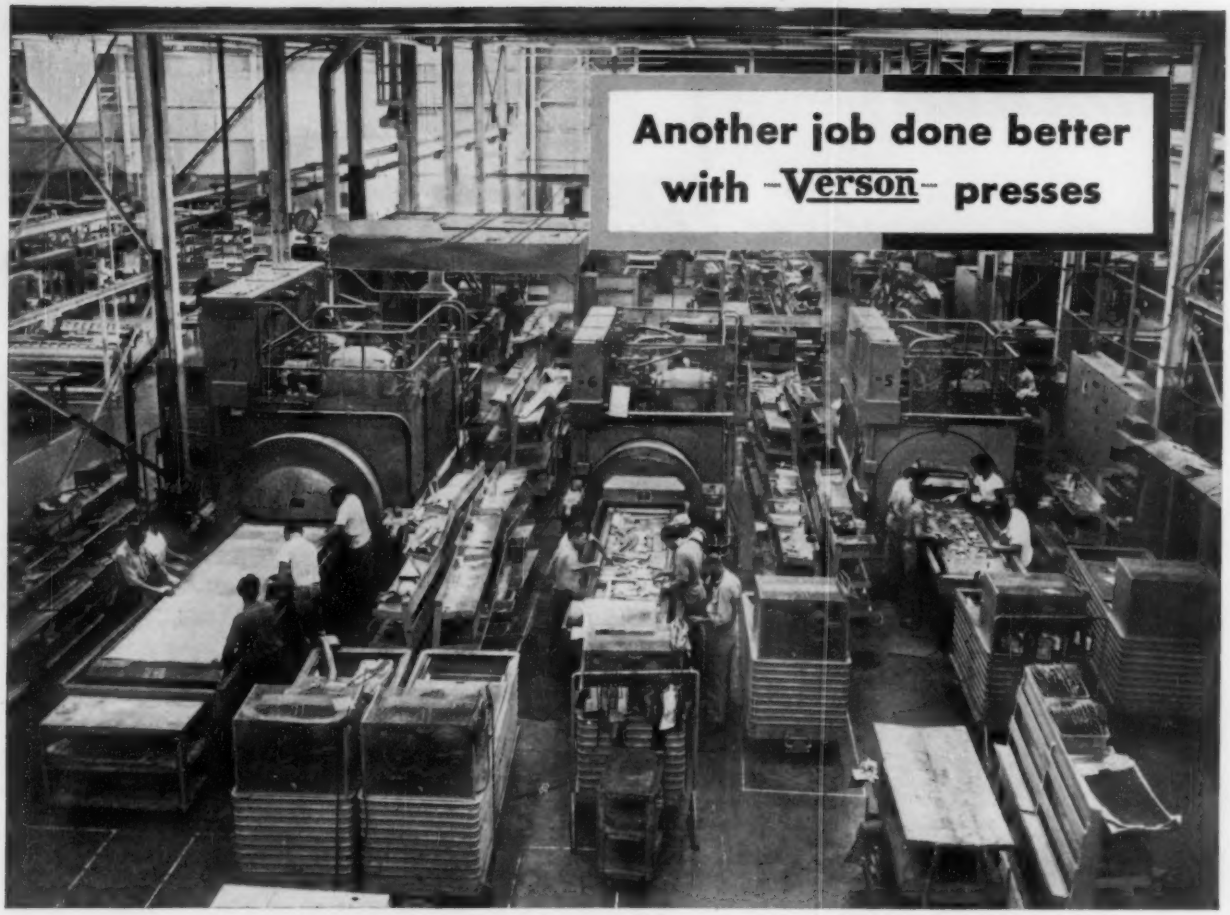

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FINANCIAL AID TO HIGHER EDUCATION

Our Colleges and Universities Are Living on Borrowed Time

. . . time borrowed from underpaid faculty members

The chart on this page tells a story of profound importance to every American. It is the story of the financial beating our college and university faculty members have been taking in the past 14 war and postwar years.

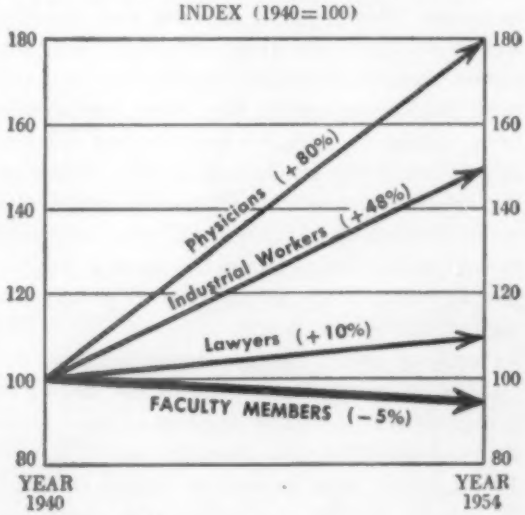
On the whole, this span of 14 years has been one of great and growing prosperity. But, as the chart shows, our college and university faculty members have, as a group, had less than no share in it.

During this period, from 1940 through 1954, the real income of the average industrial worker (that is, what his wages would purchase in goods and services) has increased by almost one-half. Among professional groups, physicians have enjoyed an increase of about 80 per cent in their real income. Lawyers, far less favored financially, have had an increase of about 10 per cent. But faculty members have not only had no increase at all; over these years of prosperity their average real income has fallen by 5 per cent. These figures do not take account of the increase in taxes since 1940.

Senior Teachers Hardest Hit

These figures are, of course, averages. For some groups of faculty members it has been better; for others worse. It has been particularly hard on senior faculty members. Between 1941 and 1953 their salaries lost about 8 per cent of their purchasing power. Being deeply committed to their careers they could not respond to alternative employment opportunities as readily as could their junior colleagues. For junior faculty members there was some increase in real income between 1941 and 1953 but only about half as much as the average for the nation.

What's Happened to College Faculty Salaries*



* Real Income before Taxes

Source: Council for Financial Aid to Education; U. S. Dep't of Commerce; U. S. Dep't of Labor.

Public Colleges Fare Better

There are also marked differences in the average financial reward received by faculty members in different types of colleges and universities. A recent study by the Council for Financial Aid to Education indicates that, in the last academic year, 1953-1954, teachers in privately endowed, independent colleges and universities were paid an average salary about $1000 less than that paid to faculty members in tax-supported institutions. The same study indicates that salaries far below the average are especially common for faculty members in the small private liberal arts colleges. This study found that during the last academic year the average salary of all college and university faculty members was about $4700.

The special difficulties under which the independent colleges and universities, and particularly the independent liberal arts colleges, are laboring to get back on their feet financially have been discussed in previous editorials in this series. These difficulties underline the need of special help for these institutions to which business firms are now contributing in increasing volume. However, the problem of providing better salaries is not peculiar to any particular type of institution.

Faculty Members Not Greedy

It is not easy to prescribe a precise standard of fair pay for college and university faculty members. This is partly because they put less weight relatively on money rewards than they put on rewards of scholarly accomplishment and prestige. Consequently, they have consistently been willing to work for very modest salaries in relation to the intellectual ability, education and application required. Obviously, however, it is the dictate both of fairness and good judgment to see that faculty members are given a roughly proportionate share in the general prosperity. Indeed, their crucial role in our society could be made to justify a larger share than this.

There is no way to know with any degree of precision what the underpayment of our college and university faculty members over the past 14 years has actually cost the nation in terms of reduced quality of intellectual performance of those institutions. One reason is that the damage has been minimized by the devoted services of many faculty members who have loyally stuck to their jobs in spite of the great financial discouragement.

It is obvious, however, that, if no grave deterioration in the intellectual performance of our colleges and universities has occurred so far, it is because we have been living on borrowed time. It is time borrowed from faculty members who have, in effect, been subsidizing these institutions by their financial sacrifice. This arrangement is not only a menace to the cultural and intellectual life of the nation, it is also a menace to our national security in a time when successful national survival may well depend in peculiar degree on the full development and utilization of our intellectual resources. We depend on our college and university faculties pre-eminently to provide this development. Adequate financial reward for such service is an elementary form of national insurance.

Many of our colleges and universities are working hard to improve the financial lot of their faculty members. Business firms are also playing an increasing role of providing the necessary financial assistance. The methods being used by business for this purpose will be the subject of another editorial in this series. However, **vastly more must be done, and quickly, to stop the financial beating being taken by our college and university faculty members if the nation's welfare and safety are to be properly protected.**

This message is one of a series prepared by the McGraw-Hill Department of Economics to help increase public knowledge and understanding of important nationwide developments that are of particular concern to the business and professional community served by our industrial and technical publications.

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LETTERS

Gen. Weyland's Book

In the Washington Roundup column of your Feb. 7 issue (p. 12), you talk about Air Force difficulties in getting Department of Defense approval for a book written by Gen. O. P. Weyland. Your article even makes reference to specific details which are included in the book.

For your information and the information of your readers, Gen. Weyland has not written a book. I assume your article was intended to explain the fact that a large New York publisher asked Gen. Weyland, through this headquarters, if he would be interested in writing a book about the Korean air war. Gen. Weyland indicated he would be interested, providing the idea was approved by Headquarters, USAF, and the Department of Defense.

The proposed book, as envisaged by the publisher, the Air Force, and Gen. Weyland, would be a "factual semi-interpretative narration of the role of the air forces in the Korean war as seen by the man who commanded the forces throughout the war. Primary consideration of the book would be the treatment of tactical and strategic aspects of the war in the air. Special recognition and study would be given the roles played by other services in the combined theater strategy." This is the exact statement that appears in the official correspondence concerning this project.

B. E. Allen
Brigadier General, USAF
Director of Information Services
Department of the Air Force
Washington, D. C.

(Editor's note: Both the offices of Fred Seaton, then Assistant Secretary of Defense for Public Affairs, and Gen. Allen were queried by Aviation Week staff men on status of Gen. Weyland's book before publication of the item in question. Neither office saw fit to furnish the information supplied by Gen. Allen until after publication of the item. Aviation Week is sorry if it disrupted Gen. Weyland's literary efforts since his story of the Korean war should be told to the American people without any Pentagon censorship.)

Navaid Decision

The ANDB plan of action described in Feb. 14 issue of Aviation Week (p. 16) states that VOR/DME backers are not giving up. Thank God they are not.

It is difficult to conceive that the existing Common System would be scrapped in favor of Tacan, which at present sounds unsound and unworkable. The consultants' report to ANDB's advisory committee definitely states: "The present Tacan equipments are unreliable and extensive re-engineering of both ground and airborne units is necessary."

The consultants also report that "Tacan cannot be expected to meet the requirements for two-way voice communication with aircraft."

In addition, the consultants said: "Before making any plan for widespread use of Tacan, it would be necessary that the prob-

lem of interference with other services in the 960 to 1215 mc. band be carefully studied and resolved."

We imagine that practically everyone in civil aviation, including many ATA members, will not give up but will fight hard to maintain the proven services provided by DME and VOR.

LAWRENCE F. ZYGMUNT
President
General Aircraft Supply Corp.
Detroit 5.

ANDB Decision

According to the Detroit News February 26 and February 28 dispatches indicate at least two congressional investigations into the ANDB decision are underway; and that the General Accounting Office is in the act.

With this storm of protest from the airways users breaking in Washington, we are greatly disappointed to note that AVIATION WEEK reported only parts of the ANDB press release, three issues back, then dropped the whole thing like a hot potato.

Is it possible that AVIATION WEEK has lost the ability it once had to dig out all of the facts in a controversy as big as this one, and report them promptly?

JAMES RIDDLE
President, Narconational
Aeronautical Corp.
Ambler, Pennsylvania

(AVIATION WEEK *reported the congressional investigation of the DME-Tacan controversy March 7 p. 14 and on March 14 p 279.* AVIATION WEEK *was the first to reveal the Vortac controversy and present a detailed report on Tacan Dec. 7, 1953, p. 40.—Ed.)*

Slopeline Lights

J. H. Cory Pearson's letter to the editor on the Slopeline lights in the Feb. 21 issue of AVIATION WEEK is probably ascribable to some sort of parental pride.

Everyone naturally hates to have his child grow up to be a sort of juvenile delinquent. As developer of the Slopeline system, he undoubtedly resents its rejection.

But let's not let personal feelings cloud the realism of this thing. No product (in this case the Slopelines) is a good product if the consumers (in this case the pilots) don't feel it is a good product and if a better competitive product (in this case the Centerline system) is available at actually less cost.

His attack on Captain Robson is thoroughly unjustified. What Captain Robson wrote may have been exclusively his own words, but it is an opinion shared by thousands upon thousands of pilots.

While Mr. Pearson speaks of thousands of test flights, he neglects to mention that the Slopelines have not proved themselves in the real and final test ground—actual operations, under actual conditions. A few test flights are insignificant considering that experience gained in years of day in and day out operation putting the lights to hundreds of thousands of tests.

The Centerline system has been approved as both the national and international standard—that in itself speaks for the relative merits of the two systems.

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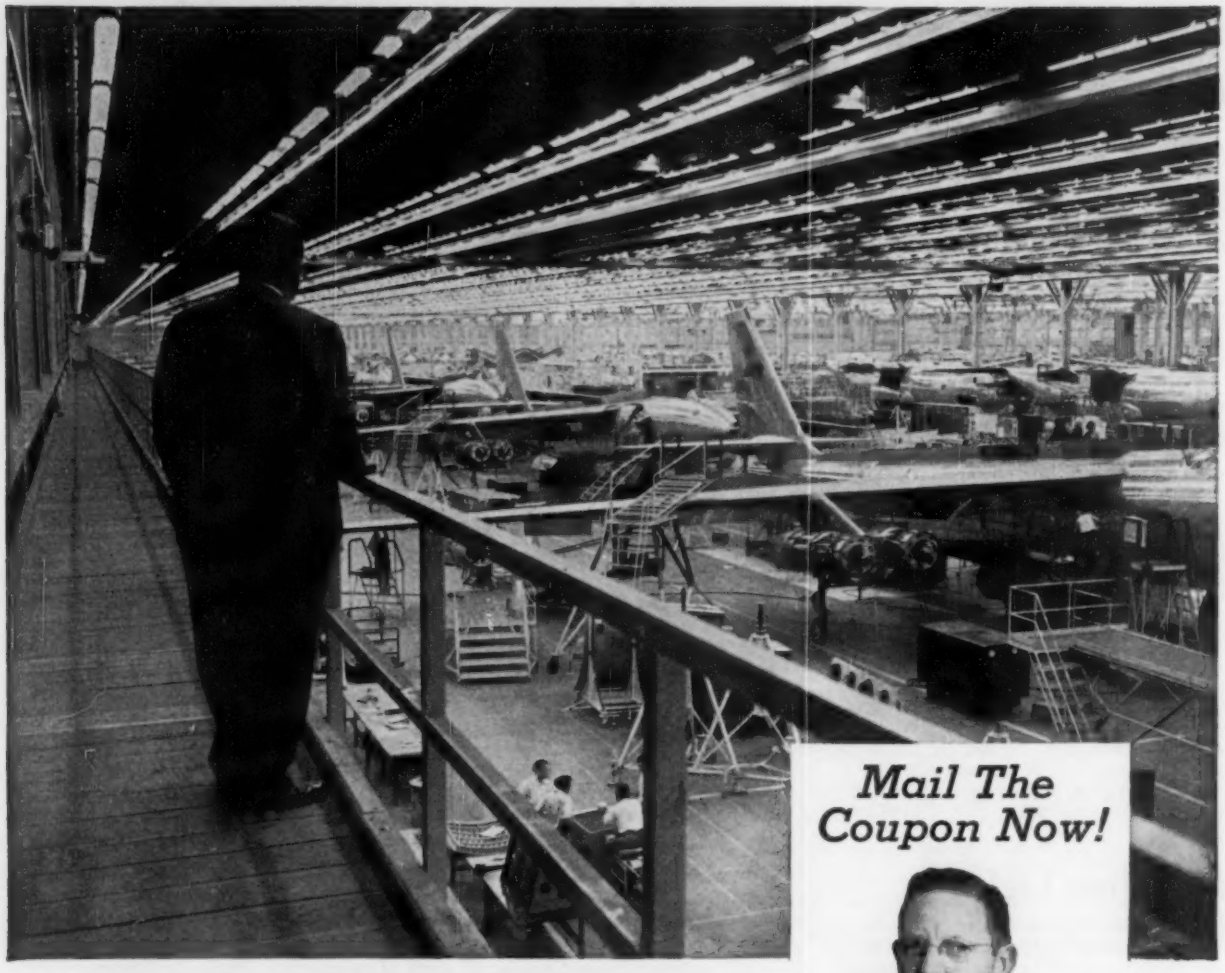

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selves up against the Slopeline. It seems to be a case of Mr. Pearson setting himelf up against the opinion of 10,000.

The record should be set straight on this.

ED MODES, Director
Publicity and Public Relations
Air Line Pilots Assn.
35th Street and Cicero Ave.
Chicago 38.

VFR Traffic Law

It was gratifying to note that you published my letter of Dec. 13. If it straightens out only a few unconscientious pilots, then at least some little good has been done.

I am, however, disappointed with two items. First, you omitted the last paragraph, the first sentence of which was of no consequence. Nevertheless, the remainder was important. Second, you did not print my signature. Perhaps you had some bonafide reason for not doing so.

I do feel, however, the impression left was that I hesitated to reveal my name. Such is not the case, and notoriety is certainly not my intention. Any statement of true fact and personal conviction should bare a true signature.

A. G. WHITE, pilot
Executive Offices
Bendix Aviation Corp.
Fisher Building
Detroit 2.

(Editor's Note: Mr. White is "A.G.W.", the executive pilot whose comments on the VFR traffic law appeared in the Jan. 17 issue of Aviation Week, p. 110. Following is the portion of his letter previously omitted: "Well, this little epistle sounds quite rough, even to me. Perhaps I'm outspoken, but a situation which has reached the proportions that this one has must be called to the attention of the CAA and the general public. It affects everyone who travels by air.")

Flap Retraction

In your Feb. 7 issue under Industry Observer we noticed in the second paragraph that airline pilots are plugging for a new safety device that will avoid premature flap retraction.

We wish to advise that our new Speed Control Instrumentation based on the measurement of lift ratios would have immediately indicated this inadvertent and premature flap retraction condition. If flaps are inadvertently operated, resulting in subsequent loss of lift, the Speed Control would show this and since an indication would immediately be given, the action that the crew took in starting a flap retraction could be immediately stopped.

This concept of measuring lift ratios was reported by AVIATION WEEK in the May 25, 1953, issue (p. 67).

This instrument principle is significant because it computes and corrects for any and all factors affecting wing lift.

K. R. DUEE, JR.
Sales Manager
Safe Flight Instrument Corp.
4 Water Street
White Plains, N. Y.

Bendix Red Bank
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With its 30-volt, 100-ampere rating, the Type 30E16 offers increased output and reliability that make it the ideal replacement for existing 50 and 75 ampere aircraft generators. In most cases, it can be used with existing control equipment—with types 1042-17 and 1589-1 voltage regulators, for example.

This generator can be furnished with either square or round mounting flange and is suitable for use on Continental R9A, P & W 985, P & W 1340, P & W 1830 and Wright GR 1820 engines.

For military applications, the generator conforms to AF Drawing 52B-6588 and will deliver full output at 35,000 feet altitude and 75% rated power at 50,000 feet.

CHARACTERISTICS

Speed	2500-4500 rpm
Min. Speed for Regulation	2500 rpm
Max. Speed for Regulation	5500 rpm
Power	3000 watts
Min. Air Blast Pressure	6 in. water
Weight	39.5 lbs.

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EATONTOWN, N. J.

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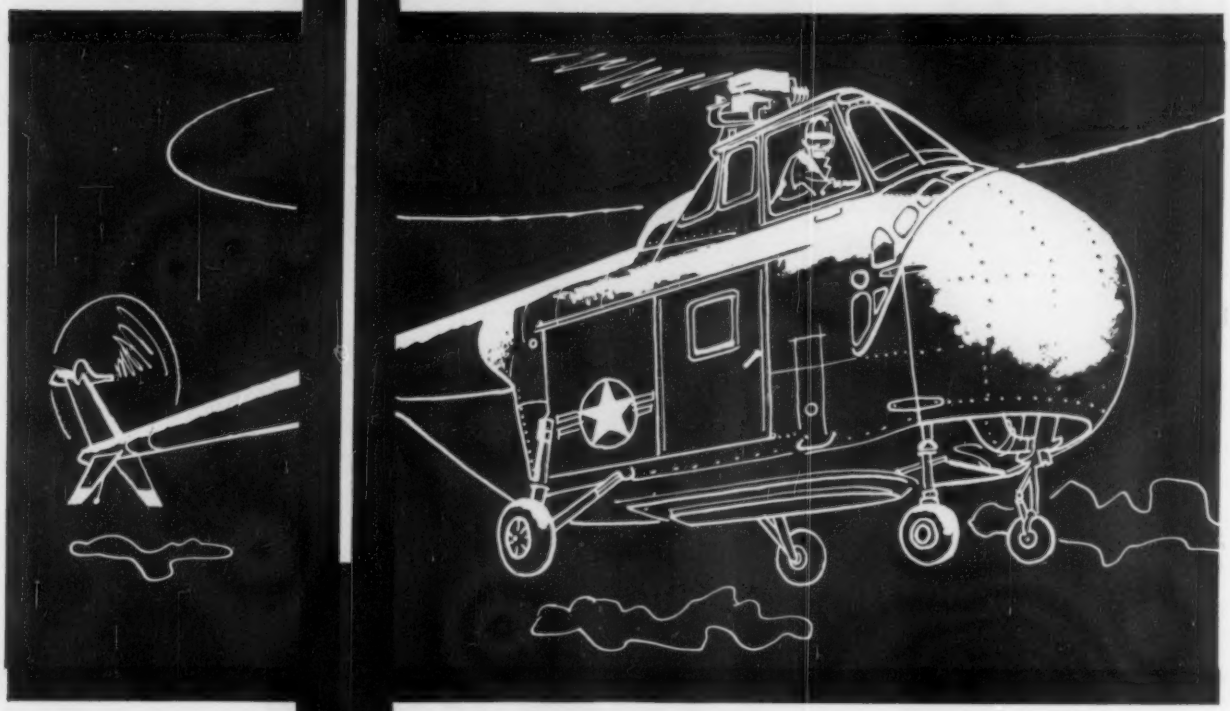
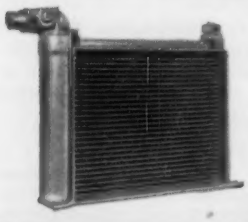
IT'S ALL A MATTER OF DEGREES!





The 'copters are coming . . . and coming fast—*and Harrison keeps them cool!* Yes, the helicopter is growing up—with new "city-center" take-off and landing sites for short-haul passenger and cargo service—*and Harrison is keeping pace!* In fact, *Harrison cools practically every 'copter that's flying today . . :* and there are good reasons for this outstanding leadership. Harrison oil coolers are designed to save weight and space, which are vital when you're carrying a payload. With our unexcelled research facilities, we're always looking for ways to make aircraft heat exchangers lighter, more dependable, more durable than ever. If you have a cooling problem, look to Harrison for the answer!

HARRISON RADIATOR DIVISION, GENERAL MOTORS CORP., LOCKPORT, N. Y.

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HARRISON

NEW AVIATION PRODUCTS

TEST UNIT checks spark plugs fast.

Tester Guards Against Spark Plug Failure

Easy-to-operate test unit for checking soundness of aircraft sparkplug insulators, is available to commercial users following adoption by USAF.

Both jet and piston-engine plugs may be checked with the device, the manufacturer claims. An oil quench prevents high voltage discharge across the gap, revealing any imperfections in the insulator tips. If the insulator is sound a tube marked "O.K." lights up, otherwise a tube marked "N.G." is illuminated.

AC Spark Plug Division, General Motors Corp., Flint, Mich.

FLUID CONNECTOR flexes to take stress.

Plastic Fuel-Oil Connector Withstands Resonance

New flexible fluid connector for aircraft fuel or oil systems can withstand extreme flexing and vibration without material fatigue, manufacturer claims.

Specially compounded synthetic elastomers line the fuel-resistant interior of the connector, which is made up of rubber impregnated fibrous glass. Aromatic fluids such as MI-H-3136 Type I or Type III can be handled without leakage, according to maker.

The connector is said to be capable of taking shear axial misalignment. Tests included temperatures ranging from −65F. to −160F. with pressures ranging from 60 psig. internal to vacuum pressures of 26 in. mercury.

Arrowhead Rubber Co., 2330 Curry St., Long Beach, Calif.

Cooling Blower Goes Into Planes, Missiles

Specifically developed for highspeed aircraft and missiles, a new axial-flow, cooling air blower is now available to civilian users.

NOSE SPINNER on blower ups efficiency.

A nose spinner in the impeller's design provides more effective blade area, reducing noise and increasing flow, the manufacturer states. Blowers can be supplied with radio noise filters.

Blower body is two-inches in diameter and is three inches long.

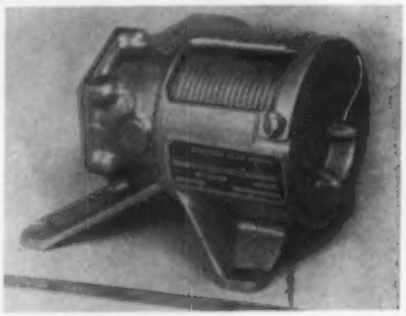
It produces 60 cu. ft. of air per min. at less than one ampere. Power is either d.c. or 400-cycle a.c.

Air Equipment Co., 2248 E. 37th St., Los Angeles, Calif.

Light Hoist Handles Loads to 1,000 Lb.

A hand-operated airborne-type hoist, that can take up to 1,000-lb. loads, has a reeling capacity of 22 ft. of $\frac{3}{16}$-in. cable and is capable of being driven with a standard $\frac{3}{8}$-in. hex socket wrench.

Ratio is five turns of input for one drum revolution providing a maximum pull-off angle of 12 deg. with an installed weight of 4.75 lb. The device meets military specifications for airborne equipment, the maker notes.



AIRBORNE HOIST weighs under 5 lb.

Western Gear Works, Lynwood, Calif.

ALSO ON THE MARKET

Height blocks and angle plates with heat-treated aluminum alloy bodies and hardened steel tops and bottoms can be used singly or in combination to provide wide range of heights for varied work requirements. Blocks range in height from five to 20 in. in 5-in. increments, with plus-or-minus 0.0005 in. parallel in 12 in. and heights to plus-or-minus 0.001 in. Angle plates are 24-72 in. high. Special sizes are available.—Machine Products Corp., 6771 E. McNichols Rd., Detroit 12.

Hand wheels for jigs and fixtures for cranking shafts are of solid aluminum alloy in 4-5-in. sizes mass-produced to reduce cost.—Jergens Tool specialty Co., 712 E. 163d St., Cleveland.

Non-contact measuring gage can be located 10-20 ft. above work, yet accurately handles work traveling at rates up to 2,000 fpm., manufacturer says. Infrared gage measuring is continuous.—Industrial Gages Corp., Englewood, N. J.

Fast battery chargers of 6-v. and 12-v. capacity will also slow-charge a line of batteries or can be used for auxiliary starting. Model F-560 is portable unit; Model F-562 is wheel-mounted and has automatic timer.—Allen Electric & Equipment Co., Kalamazoo, Mich.

Insulated terminal, called Thermolug, is designed for operation in aircraft where temperatures approach 400 F, such as fire alarm systems. Moisture pickup is said to be nil and resistance to most oils and chemicals is excellent. Meets MIL-T-7928A.—Burndy Engineering Co., Inc., Norwalk, Conn.

Yes, weight is an important factor in selecting the right castings.

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AVIATION CALENDAR

Mar. 21-24—Institute of Radio Engineers, national conference, Waldorf-Astoria Hotel, Kingsbridge Armory, New York.

Mar. 29-Apr. 1—American Society for Metals, ninth Western Metal Exposition and Congress, Pan Pacific Auditorium and Ambassador Hotel, Los Angeles.

Mar. 31-Apr. 1—Symposium on Boundary Layer effects in Aerodynamics, Britain's National Physical Laboratory, Teddington, England.

Apr. 4-6—National Fluid Power Assn., second annual meeting, Broadmoor Hotel, Colorado Springs, Colo.

Apr. 5-7—Radio Technical Commission for Aeronautics, spring assembly and joint meeting with the Institute of Radio Engineers, Los Angeles.

Apr. 13-15—American Society of Lubrication Engineers, 10th annual meeting, Hotel Sherman, Chicago.

Apr. 14-15—American Ordnance Assn., symposium of Proving Ground Instrumentation Committee, Patrick Air Force Base, Florida.

Apr. 16-20—American Association of Airport Executives, 1955 annual convention and business meeting, El Conquistador Hotel, Tucson, Ariz.

Apr. 18-21—Society of Automotive Engineers, Golden Anniversary Aeronautic Meeting, Aeronautic Production Forum and Aircraft Engineering Display, Hotel Statler and McAlpin Hotel, New York.

Apr. 18-21—American Society of Mechanical Engineers, Diamond Jubilee spring meeting, including four aviation sessions, Lord Baltimore Hotel, Baltimore.

Apr. 20-22—American Rocket Society, spring meeting, Baltimore.

Apr. 27-29—Society for Experimental Stress Analysis, spring meeting, Hotel Statler, Los Angeles.

Apr. 27-30—American Helicopter Society, 11th annual forum, Hotel Mayflower, Washington, D. C.

Apr. 28-29—Michigan Aeronautical Conference, University of Michigan, Ann Arbor.

Apr. 29—Eastern regional meeting of Institute of Navigation, Friendship Airport, Baltimore, Md.

Apr. 29-30—New England radio-electronics meeting, sponsored by Boston and Connecticut Valley sections of IRE, Sheraton Plaza Hotel, Boston.

May 2-5—Society of Aeronautical Weight Engineers, national conference, Hilton Hotel, Ft. Worth.

May 4-6—Fourth International Aviation Trade Show, 69th Regiment Armory, New York.

May 7-8—Association of Northeastern College Flying Clubs, annual inter-collegiate air meet, Troy (N. Y.) Municipal Airport.

May 16-20—National Materials Handling Exposition, produced by Clapp & Poliak, International Amphitheatre, Chicago.

May 23-24—American Society for Quality Control, ninth annual convention, Hotels Statler and New Yorker, New York.

May 30—Federation Aeronautique Internationale and KNVvL Royal Netherlands Aeroclub, fifth Internation Air Display, Ypenburg Aerodrome, The Hague.

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HAVE YOU A DISASTER PLAN FOR YOUR PLANT?

BOMBS... OR FIRE... OR FLOOD... OR TORNADO ... you can handle them if you act now.

Let's face it... the threat of war and the atomic bomb has become a real part of our life—and will be with us for years. Fires, tornadoes and other disasters, too, can strike without warning.

Whatever the emergency is, everybody's going to want help at the same time. It may be hours before outside help reaches you. The best chance of survival for you and your workers—and the fastest way to get back into production—is to know what to do and be ready to do it. Disaster may happen TOMORROW. Take these simple precautions TODAY:

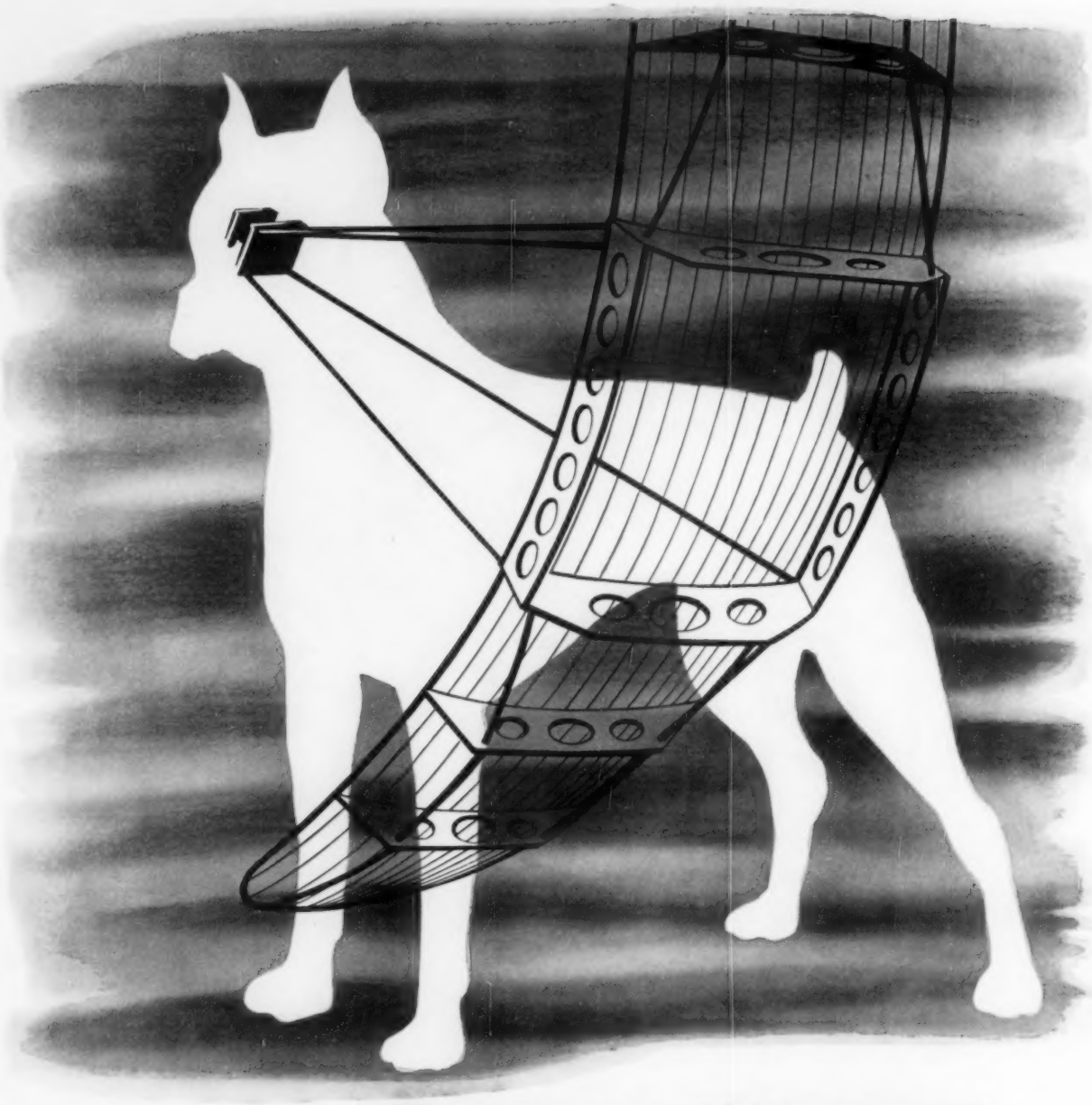
☐ **Call your local** Civil Defense Director. He'll help you set up a plan for your offices and plant—a plan that's safer, because it's integrated with community Civil Defense action.

☐ **Check contents** and locations of first-aid kits. Be sure they're adequate and up to date. Here, again, your CD Director can help. He'll advise you on supplies needed for injuries due to blast, radiation, etc.

☐ **Encourage personnel** to attend Red Cross First-Aid Training Courses. They may save your life.

☐ **Encourage your staff** and your community to have their homes prepared. Run ads in your plant paper, in local newspapers, over TV and radio, on bulletin boards. Your CD Director can show you ads and official CD films or literature that you can sponsor locally. Set the standard of preparedness in your plant city. There's no better way of building prestige and good community relations—and no greater way of helping America.

Act now . . . check off these four simple points . . . before it's too late.



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CINCINNATI 15, OHIO

Congress Retackles Navigation Systems

Three committees mix in debate over merits of Tacan vs. civil DME. Military cites defense requirements.

By Preble Staver

Congress apparently is going to decide again whether there will be a common civil-military short range air navigation system and, if so, which one —military Tacan or civil VOR/DME.

Three major Congressional investigations are independently reviewing the recent Air Navigation and Development Board's decision to substitute the Tacan system for the previously agreed upon VOR/DME system. Coupled with the investigations already under way is the prospect of a fourth Congressional group getting into the act and a pending proposal in the Senate for creation of a special joint committee to conduct a full scale investigation into the controversy.

▶ **Cross Purposes?**—Likelihood of establishing a joint committee, which was proposed by Sen. Styles Bridges, is considered remote, however. The proposal has been referred to the Senate Commerce Committee, which is one of the three groups studying the problem.

Other inquiries that would be hard to stop at this point are being conducted by a House Commerce subcommittee and the Military Operations subcommittee of the House Government Operations Committee. All of these groups are working independent of each other, possibly at cross purposes.

First to hold hearings was the House Government Operations subcommittee, headed by Rep. Chet Holifield. A closed-door meeting, with military witnesses only, was held Mar. 1. A week later the first and only public session to date was called.

▶ **'Going To Find Out'**—Chairman Holifield set the tenor of the hearing when he stated its purpose was to determine if Tacan was a "wise" procurement. "We're going to find out if this item (Tacan) is a better item than the one for which $117 million has been spent and going to junk," Holifield said. The question is raised, he said, because Tacan has not yet been proven to be operable but there has been production contracts let with the system still in the research and development stage.

First witness for the Defense Department was Donald A. Quarles, Assistant Secretary for Research and Development, who defended the military's action in developing Tacan and the ANDB decision to make it the common system.

His testimony was supported by Air Force Assistant Secretary Trevor Gardner and Cmdr. R. E. Laub, Navy electronics expert, who detailed the procurement of Tacan from its inception.

▶ **Deficiency Claimed**—Quarles told the committee the deficiency of VOR/DME for military application was common knowledge as far back as 1947. He said he thought the military was justified in going ahead with its secret system because of a very real need for tactical equipment. Tacan couldn't be released for common use because of security, he claimed, but acknowledged that declassification is now in process.

The original decision, Quarles said, to install and equip with VOR/DME was made solely by Civil Aeronautics Administration and its implementation tackled with CAA's "typical vigor and aggressiveness." However, he noted, the DME portion of the civil system hasn't been generally accepted by the aviation public. An example cited by Quarles as reflecting the lack of importance of DME to the airlines was the fact that they haven't thought it necessary to purchase and install the equipment even though the CAA ground equipment was being installed.

The ANDB decision this year to proceed with development of Tacan for eventual use as the common system is in the public interest because it promises a much improved common civil-military system than VOR/DME, according to Quarles. He said three major reasons for making the change now are:

- It will be the least costly to the taxpayer.
- It best satisfies the needs of both national defense and civil aviation.
- It minimizes further expenditure for equipment having limited utility.

▶ **VOR Procurement**—Trevor Gardner said the Air Force has an equally large investment in both VOR and Tacan. But, he said, "VOR will be obsolete by 1965 and by that time full use will have been made of the equipment and we'll have gotten our money's worth." The Air Force procurement of VOR as outlined by Gardner has been for 26,000 sets of which 24,500 have been received and 8,037 installed. Out of

Tacan History

Chronological history of Navy contract action for Tacan development, evaluation and procurement.

Date	Action
June 1948	Development contract to Federal Telecommunications Laboratories for one airborne unit (ARN-16) and one surface unit (URN-1).
June 1949	Development contract to Federal for ARN-21(XN-1) and URN-3(XN-1).
June 1950	Contract to Federal for 10 evaluation models of ARN-21(XN-1).
July 1950	Ordered acceleration, including overtime, on evaluation contract.
March 1951	Decided on ARN-21(XN-1) and URN-3(XN-1) after evaluation.
June 1951	Letter of intent for production issued to Federal Telephone and Radio Co.
December 1951	Production contract to Federal; letters of intent for sub-contracts to Stromberg-Carlson and Hoffman Laboratories.
September 1952	Federal delivered first of 40 ARN-21's; balance in succeeding months.
May 1953	Federal delivered three URN-3 pilot-run models.
January 1954	Federal began deliveries of production ARN-21's; total of 400 sets released for production.
February 1954	Production contract with Federal for 2,935 ARN-21 sets.
August 1954	Production contract with Stromberg-Carlson for 3,652 ARN-21 sets.
September 1954	Production contract with Federal for 625 URN-3 sets.
October 1954	Production contract with Hoffman for 2,175 ARN-21 sets.
January 1955	Federal began deliveries of first 55 URN-3's.
March 1955	Production rate for ARN-21 at 80 per month; scheduled for a combined total of 1,335 per month by August or September.

Tacan Contracts

Following production contracts for Tacan equipment, both airborne and surface units, have been awarded by the Navy to three manufacturers.

Airborne Units (AN/ARN-21)

Contractor	Value	Units	Service
Federal Telephone and Radio Co.	$33,380,153	1,359	Navy
		1,154	USAF
		422	MDAP
Federal Telephone and Radio Co. Subcontracts to:			
Stromberg-Carlson, Inc.	2,857,464	250	Navy
Hoffman Laboratories	2,744,565	250	Navy
Stromberg-Carlson, Inc.	30,975,866	1,540	Navy
		2,112	USAF
Hoffman Laboratories	24,576,255	780	Navy
		1,395	USAF
Sub-total	$94,534,303	9,262	

Surface Units (AN/URN-3)

Federal Telephone and Radio Co.	67,384,603	202	Navy
		423	USAF
(Special tooling)	2,139,000	.....	.....
Sub-total	$69,523,603	625	

Research and Development

Federal Telecommunications Laboratories, etc.	$9,726,893
Total contract value	$173,784,799

the total 26,000 the Navy has received 4,800 sets through the Air Force with another 700 programmed.

The cost of Tacan to date for the Air Force was estimated at $100 million exclusive of installation costs, which includes more than 5,000 airborne and surface units. Gardner commented that aside from the financial interest in the Tacan program the Air Force has a deep interest in its assigned responsibility for continental defense. This accounts for USAF interest in some of the tighter specifications of the Tacan system, he said.

▶ **Necessary Step**—Gardner and Quarles agreed that Tacan has not been perfected in manufacture to the point where it is reliable equipment.

Holifield asked Gardner: "Why not a research and development contract for some 400 units instead of a production contract for 5,000?"

Gardner replied: "It is necessary to put such items into production before they're ready. If we wait for final development an item, and this includes the B-36, super carrier, what have you, we will be hopelessly behind the enemy. . . We will be continuing to develop Tacan for the next five years. This goes on in every one of these procurements, it just happens to show in this one."

After the two defense department spokesmen temporarily completed testimony before Holifield's committee, they made the rounds of the other interested groups. In successive days, they appeared before Rep. Oren Harris' House Commerce subcommittee and Sen. Warren Magnuson's Senate Commerce subcommittee. These successive hearings were shrouded in secrecy, despite many declarations that as much of the testimony as possible would be in open sessions.

▶ **Viewpoints**—Rep. Peter Mack said it will be impossible to operate a dual system of navigation. "I think it's important that we make a detailed study of the two proposals," he said.

Maj. Gen. Gordon A. Blake, USAF's Director of Communications said:

"VOR azimuth and the azimuth portion of Tacan are not competitive and not incompatible; we're using VOR and will continue to use it, but the distance measuring portion of the civil system (DME) and distance measuring portion of Tacan are competitive and are incompatible. The latter is the point we're trying to solve."

Cole Morrow, National Business Aircraft Assn. representative, said:

"Do we have or have we ever had the common system which Congress and the civil users thought we had and for which Congress appropriated large sums of money to implement."

Morrow added: "If the military can force on the Common System an incompatible tactical system, which it has secretly developed and which has not been coordinated through the proper channels such as ACC or ANDB and thereby destroy the Common System which has been coordinated, accepted and agreed to in these same agencies by the same military representatives, then our democratic form of government is in jeopardy."

3-Cent Airmail

● Post Office wants service put on permanent basis, cites $154,000 saving.

Post Office Department estimates a saving of $154,000 so far through the air shipment of first-class three-cent mail on an experimental basis and wants to continue the service on a "permanent basis," according to Postmaster General Arthur Summerfield.

He anticipated that a General Accounting Office audit, now underway, would prove the department's estimated saving "substantially" correct.

▶ **Court Action**—Post Office has requested Justice Department to appeal the decision of U. S. District Court Judge James Kirkland that the transport of the three-cent mail by air on a permanent basis would require authorizing legislation. However, Judge Kirkland denied the petition of five railroads for an injunction halting the service, maintaining that the postmaster had authority to experiment as long as the test period did not last too long (AW Feb. 14, p. 110).

If the appeal is granted, the case will be re-tried in the U. S. Court of Appeals for the District of Columbia.

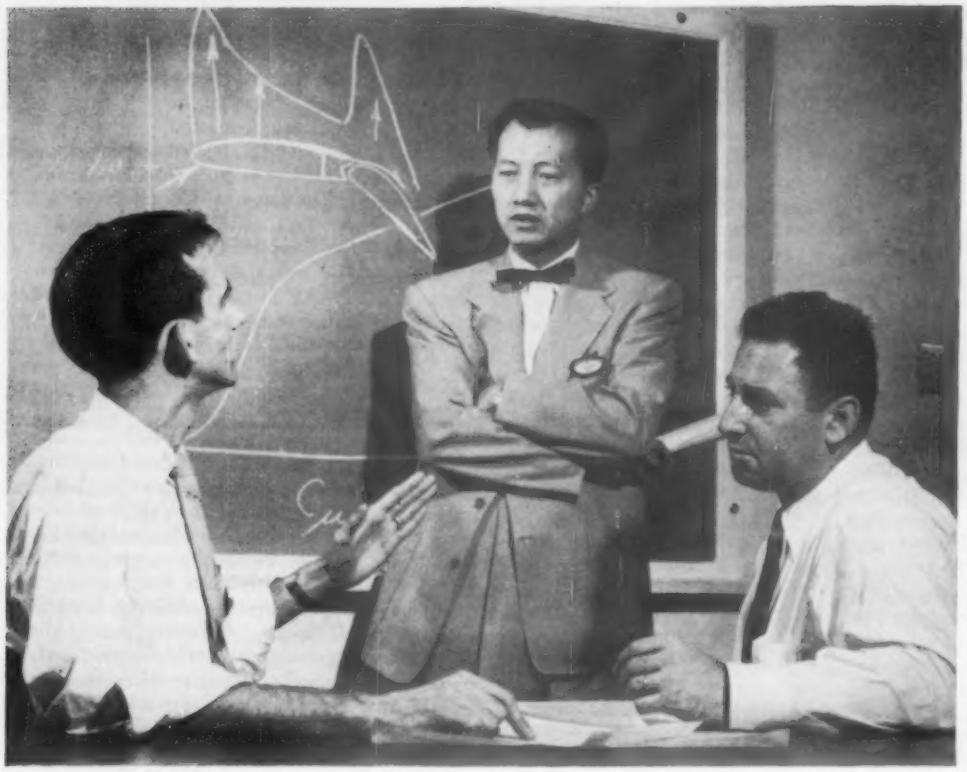
"If we find it necessary, we certainly are going to ask for legislative assistance" to continue the air shipment of three-cent letters on a space-available basis, Summerfield told the House Appropriations Committee, "because, frankly, we consider it not only an economic necessity, but as a part of our defense and military program, we feel it is essential that we be permitted to proceed."

Referring to railroad opposition to the air shipment of surface mail, Summerfield observed:

"They seem to be following in the footsteps of the people that preceded them in the handling of mail in the old days by pony express and who, in turn, resisted any change because they lost revenue. . . . And apparently the railroads are concerned because they probably foresee what we foresee, that the public having seen the improved service might want it continued. . . ."

▶ **Two choices**—He complained that "the railroads are removing their mail-carrying trains from their schedules and forcing us to use other means of transport" and at the same time are "trying to restrain us from experimenting in the movement of mail by air."

In many cases, Summerfield declared,



Richard Cantrell, aerodynamicist (left), Jim Hong, Aerodynamics Division head (center) and Irving Litrownik, aerodynamics engineer and boundary layer control specialist, discuss effects of blowing boundary layer control on lift increments and pressure distribution.

Hovering to high-speed flight:

Lockheed expansion program offers wide range of aerodynamics assignments

Now in a stage of major expansion, the Aerodynamics Division is one of the fastest-growing organizations at Lockheed, with unusual opportunities for achievement and promotion. Assignments cover virtually the entire spectrum of aerodynamics endeavor.

The expansion program includes such projects as nuclear applications to aircraft, extraordinarily high-speed fighters, new concepts in vertical rising aircraft, advanced versions of trainers and bombers, turbo-prop and jet transports, and a number of significant activities. Typical aerodynamics problems are:

1. Estimate improvements in maximum lift of sweptback wings with Boundary Layer Control for use in future commercial transports.
2. Estimate maximum speed and altitude capabilities of advanced supersonic military designs.
3. Determine ability of vertical rising aircraft to make transition from horizontal to vertical flight.
4. Estimate direct operating costs of new turbo-prop commercial transport under wide range of operating conditions.
5. Determine design tail loads on turbo-prop cargo airplane for all types of engine failure.
6. Determine ability of new trainer to make carrier landings and catapult take-off.
7. Establish design criteria for auxiliary damping servomechanisms on future fighters.
8. Optimize approach and landing technique for use on rough, short fields by rescue aircraft.

LOCKHEED
AIRCRAFT CORPORATION
BURBANK **CALIFORNIA**

Career-minded Aerodynamics Engineers and Aerodynamicists are invited to participate in this expansion program. Address inquiries to E. W. Des Lauriers, Dept. A-3-3.

we are faced with one of two choices: "Put the mail in the air or put it on the already congested highways of the nation."

Other points made in Summerfield's testimony were:

- Cost of airmail transportation will be slightly higher in Fiscal 1956 ($54.4 million) than in Fiscal 1955 ($53.3 million). The cost for domestic airmail transportation in expected to rise from $39 million in fiscal 1955 to $39.8 million in Fiscal 1956, and for foreign airmail from $14.3 million to $14.6 million.
- This compares with $331 million for rail mail transportation in Fiscal 1955 and $338 million in Fiscal 1956.
- The domestic airmail volume is expected to increase 4.9% in Fiscal 1955 and another 5.3% in Fiscal 1956.
- Domestic airmail revenue is estimated at $137 million for Fiscal 1955 and $145 million for Fiscal 1956.
- The department loses approximately $600,000 annually by shipping mail on foreign airlines at Universal Postal Union rates, substantially higher than the mail rates paid U. S. international carriers. "For diplomatic reasons," Albert Robertson, Assistant Postmaster General, said, "we believe it is preferable to continue the use of foreign carriers."

House Committee Cuts Subsidy to $5 Million

Civil Aeronautics Board's request for $15.2 million to finance airline subsidy payments for the remainder of fiscal 1955 was cut to $5 million by House Appropriations Committee with critical comments concerning the Board and Pan American World Airways.

Despite extensive testimony by CAB Member Chan Gurney on steps which have sharply reduced subsidy requirements, the committee, in making the $10.2 million reduction, had these two complaints:

- **First,** the Board's $15.2 million request does not reflect reductions from application of the Supreme Court decision last year establishing the so-called offset principle under which excess earnings of an airline are to be applied against losses on another division.

At hearings, Gurney said that there is only one possibility—Trans World Airlines—in which the application of the offset principle "could" have an affect on Fiscal 1955 and Fiscal 1956 subsidy requirements. His outlook, however, was that it would not.

▶ **'Too Early'**—The Board estimates that TWA's domestic and international divisions will both be subsidy free in these years, leaving nothing to offset. But, if the Board's decision on the service mail rate for TWA's trans-Atlantic operation should develop a requirement for subsidy, the Board believes that domestic earnings would be sufficient to offset this.

Possible refunds to the government as a result of the offset principle, Gurney reported, involve the operations of five carriers for years prior to Fiscal 1955.

- **Second,** the committee objected that the Board has not completed a satisfactory audit of Pan American. The committee quoted the finding of its investigative staff that "most of the subsidiaries have never been properly audited and some not at all, and there has not been insistence that the operations of the entire (PAA) system be treated as an entity. . . . If corrective action were taken, substantial cuts in subsidy should result."

Defending the Board at committee hearings against attack from Rep. John Rooney, long-time critic of Pan American, Gurney reported that CAB has had a total of 15 auditors over a period of a year investigating PAA's three divisions and International Hotels Corp., a 100% owned affiliate. CAB is now proceeding to audit the records of other affiliates, it was added.

CAB's estimate of a year ago was that $73 million in new money would be needed in Fiscal 1955 to finance airline subsidies. This has been reduced by $17.8 million to $55.2 million.

Reconfirmation

The controversial reconfirmation rule has been repealed by a mail vote of the member airlines of the Air Traffic Conference. The action, effective June 15, leaves individual carriers free to continue the rule or drop it at their discretion.

Opposition to the rule has grown over the past months as the no-show problem, which it was supposed to solve, remains as bad as ever.

American Airlines, which led the fight against reconfirmation, says it will propose a plan at the May meeting of the Conference calling for a "reasonable penalty" to be imposed against no-shows.

Truck-Air-Truck Plan Opens Slick's Drive

Slick Airways is starting a new transcontinental truck-air-truck cargo services (AW Nov. 22, p. 91) in one of the first attempts to cut airfreight rates to a level competitive with Railway Express.

The airfreight line will open the new operation within the next 30 days, connected with Associated Transport in the East and Consolidated Freightways of Portland and Western Truck Lines of Los Angeles in the West.

Slick will charge approximately $19.50 per 100 lb. for its door-to-door service, compared with $28 for regular airfreight. Maximum delivery time will be 60 hours. Between metropolitan centers overnight service is promised.

▶ **Increased Volume**—The truck-air-truck service would be available to all 20 cities on the scheduled cargo line's routes.

Besides increasing the volume of airfreight—enabling Slick to further reduce rates, which are currently one-third of Air Express, board chairman Delos W. Rentzel says, "the truck-air-truck system will enable us to operate seven days a week instead of on the present five-day schedule. It will open up on a large scale for the first time the transportation by air of household articles, at approximately the cost of present ground transportation."

▶ **Airfreight vs. Passenger**—Rentzel predicts the overall airfreight business will expand to a revenue volume equal to, and probably greater than, scheduled airline passenger traffic through similar attempts to cut cargo rates.

He says new transports will reduce the cost of airfreight even further.

"Our three Douglas DC-6As operate at 10 cents a ton-mile, compared with from 15 to 16 cents for the C-46s," he says. "Lockheed's turboprop C-130A would bring the operating cost down to 6 cents per ton-mile.

"And later series of turboprop cargo transports will cut this cost to 3 cents."

▶ **Turboprop Bid**—Rentzel's mention of turboprop transport operating cost is interpreted by industry observers as a bid to lease the USAF aircraft, on terms similar to the DC-6A rental set up between the Navy and Slick last month (AW Feb. 28, p 13).

"The industry can absorb 1,000 military turboprop transports on a lease-rental basis," he says. "We could hold them in reserve and make them available to the military on 48 hours notice."

Titanium Airlift

Slick Airways now is operating a modified version of its new truck-air-truck cargo system.

The all-cargo line flies titanium ingots, shipped by truck from Henderson, Nev., to Los Angeles, to Pittsburgh where final delivery to Breckenridge, Pa., is completed by surface transport.

The metal airlift, set up between Titanium Metals in the West and Allegheny-Ludlum in the East, takes an estimated 16 hours for each delivery and costs approximately $15.00 per 100 lb.

Pilots Shy at Reporting Flight Incidents

• ALPA safety forum told lawyers abuse reports; poor airports, also, are hazards.

By Gordon Conley

Chicago—Two big blocks to a zero fatality rate in air transportation are accident-prone airports and Civil Aeronautics Administration's new barriers to reports of unsafe flying, members of the Air Line Pilots Assn. said at their third annual Safety Forum.

"I'm interested in how to keep from being killed," commented one pilot. "But when I report an incident to make sure it doesn't happen again, likely as not a CAA attorney charges me with a violation."

"Most airports don't come up to safety standards," said another ALPA member. "As a matter of fact, much airline training is just a crutch to make up for unsafe airports."

► **Industry Effort**—The two pilots summed up the general feeling of nearly 200 ALPA delegates, aviation industry representatives and flight safety experts at the three-day forum held here Mar. 8-10.

The forum also covered pilot training needs, all-weather flying programs and problems of transition from transports powered by piston engines to turboprop airliners.

Accident Prevention

Most CAA observers at the forum privately agreed that accident prevention was set back last December when the responsibility for enforcing federal flight regulations was shifted from the Office of Aviation Safety to the General Counsel.

Under the old system, CAA safety experts acted as "father confessors" to pilots and looked over incident reports primarily to find ways to prevent accidents.

Now the attorneys scan the reports for possible violations, making the pilots reluctant to lay themselves open to prosecution.

Clarence N. Sayen, ALPA president, put it this way: ". . . One of the primary safety functions of the airline pilot is discovering and reporting air safety problems. Anything that interrupts or interferes with the free flow of this information in itself constitutes a hazard."

► **'Powerful Obstruction'**—Sayen was supported by Jerome Lederer, director of the Flight Safety Foundation, who described pilots as the most important factor in reporting dangerous incidents.

"But a . . . powerful and understandable obstruction to the reporting of dangers is . . . the pilot does not want to involve himself in further trouble or in any way jeopardize his reputation or his pilot's certificate," Lederer told the forum.

"This is a very serious situation. It is the result of actions taken by government lawyers who feel impelled by their interpretations of the Civil Aeronautics Act to investigate incident reports for the purpose of determining whether a regulation has been violated so that punitive action can then be taken.

"No responsible person condones culpable negligence, but modern ideas of punishment depart considerably from the old concept that punitive measures are effective in correcting dangerous attitudes."

► **Flight Recorder**—As a supplement to pilot reports, Lederer proposed mechanical recording devices similar to those that are currently employed by some railroads and buses.

"Flight recorders, if not used as mechanical spies or as a basis for punitive measures, could act as a means to avoid

Four-Turboprop Convair

Convair is making a new bid for the short-to-medium-range turboprop transport market with an airliner powered by four Rolls-Royce RDa7 Dart engines, company project engineer J. T. Ready, Jr., announced at the Air Line Pilot Assn. Safety Forum.

The new Dart proposal is in addition to studies of Convair Liners powered by Allison, Napier Eland and Mamba turboprops (AW Aug. 23, p. 17).

It would have a range of 1,540 miles and a cruise airspeed of 330 mph. at 13,000 feet. This range would be possible by using two 2,000-gal. tip tanks to supplement the integral wing load of 2,000 gallons.

Full payload of the 60-passenger transport would total 14,500 lb., he said. Other statistics include: maximum structural weight, 68,000 lb.; maximum landing weight, 59,800 lb., runway distance required for a takeoff and landing with full payload and fuel for a 200-mile flight, 4,500 feet.

The wing plan form and area of the Convair Dart proposal is about the same as the Model 340. But the transport's tail, almost identical to the YC-131C design, is about 12 inches higher and 20 inches wider on each side than the 340.

Fuselage has the same cross section as its piston-engine predecessor but is about 18 feet longer to accommodate more passengers and nose radar.

The RDa7 turboprop engines are mounted in four monocoque nacelles that are structurally integral with the wing. Inboard nacelles are longer and wider than outboard nacelles to allow for main landing gear retracting wells.

Simulators vs. Procedural Trainers

An American Airlines observer at the Air Line Pilots Assn. Safety Forum called flight simulators too expensive and claimed new low-cost procedural trainers being developed by AA give "just about the same results."

But a spokesman for United Air Lines, equipped with four of Curtiss-Wright Corp.'s Dehmels, said the extra margin of training given by a simulator is the answer to cutting down further air transport fatalities.

W. W. Braznell, American's director of flight operations, estimated that simulators cost $1 million to buy and install plus an additional $1 million a year to operate, including the expense of lost pilot time.

"Our procedural trainers (cockpit mockups) cost about $80,000 to build and install," he said. "The operating expense is about 10% of a simulator operation.

"American pilots are limited to 85 hours a month. This means any device we use must be reasonable enough in price so that we can afford to put them in centers with the highest concentration of pilots."

Capt. J. Sandow, chief of flight simulator training for UAL, said it would be hard to measure the cost of Dehmels against the lives of airline passengers—"and that is the difference."

"With simulators," he added, "we can find that needle in the haystack that may cause an accident."

Sandow revealed, however, that United intends to defray the cost of its Dehmels by renting its facilities to other airlines. He said UAL is hiring 32 extra men to fill in the gaps caused by rotating crews to the simulator training centers.

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accidents by reporting incidents."

The safety expert said recorders would:

- **Uncover incorrect practices** and operating complacencies that the pilot or airline accepts without realizing the dangers.
- **Check weather forecasts,** especially turbulence, thus adding to the improvement of meteorology.
- **Aid accident investigators** and, in many instances, protect the pilot's reputation.
- **Explore new operations** such as jet and turboprop, for economic and other statistical information.

Lederer said flight monitors would accomplish this by recording what the pilot sees or hears during flights and photographing takeoffs and landings.

Airport Standards

Pilots at the Safety Forum said the government should set up certificates for airports and force them to meet minimum safety standards. Many ALPA members declared that financing improvements to meet the standards should be a local effort, not the responsibility of federal aid.

"Put it on a basis of what an airport means to the community," one proposed. "If they want an airport, they have to meet certification standards. If they want to attract industry or keep what they have, an airport is a must."

► **Crash Record**—Theodore G. Linnert, chief of ALPA's engineering and air safety department, said the organization's records show certain types of crashes occur repeatedly on the airport or within a half-mile radius.

To prove airports lack safety requirements, he listed as the cause of these accidents: inadequate approach lights; lack of runway marking; lack of friction near runway surfaces; ditches near the runway ends; close-in hazardous obstructions; sharp rises at the approach ends of runways, and lack of fire-fighting equipment.

► **Feeder Problem**—A local-service airline pilot told the forum that feeder airports present a special problem.

"Improvements cost money," he said, "and these small secondary airports get no federal aid. When considering the needs of secondary fields, you should also try to find low-cost safety aids."

He also reported that small airports are reluctant to start improvement programs because "heliports are just around the corner."

All-Weather Flying

On airport facilities for all-weather flight, Col. J. Francis Taylor, Jr., director of the Air Navigation Board, said radar has increased the rate of handling

traffic in terminal areas more than any other device.

But Taylor, in a prepared statement read by ANDB's Sam Saint, told the Safety Forum that these problems must be solved in order to get the best out of radar:

- **Aircraft altitude** is not shown on the display scope.
- **Identification of planes** is not established with sufficient ease. After an aircraft has been tagged, it is difficult to keep identity continuously available to the air traffic controller.
- **Noise or clutter** appears on the radar scope during storms and some types of precipitation, making it difficult to track airplanes.
- **Correlation problems** exist between the radar display and strip postings now used in air traffic control centers.
- **Tube displays** are not big and bright enough for controllers to see in a reasonably high ambient light.

Taylor said identity and weather clutter problems will be reduced and altitude display improved by ANDB's type 3 radar safety beacon (transponder), now being tested at CAA's Technical Development and Evaluation Center and scheduled for in-service trials early next year in the New York-Washington-Norfolk area.

"This beacon represents what we of ANDB believe to be a true common system item," the USAF colonel said. "By this time I mean it is completely compatible with the military beacon system."

▶ **Policing Tool?**—Some pilots showed a lack of enthusiasm for radar because of incidents that they believe indicate CAA intends to use radar as a policing tool.

Eastern Air Lines' Capt. G. M. Sheridan said pilots of Pan American World Airways, National Airlines and EAL have had several run-ins with CAA radar operators at Miami.

"We said if radar is going to be used as a policing agent, we'd refuse to use it," he reported. "But we got no satisfaction from anyone in CAA, including (Civil Aeronautics Administrator) Fred Lee."

Turboprop Transition

Representatives of Capital Airlines and CAA told ALPA members they believe the transition from piston-engine airliners to turboprop-powered transports can be accomplished with reasonable ease.

▶ **Viscount Advantages**—Capital's Capt. Henry S. Weigel, who has started indoctrination flights on the airline's Vickers Viscounts, said he believes the British transport will be simpler to operate, "especially when automatic fuel trimming comes into use."

He cited these other advantages:

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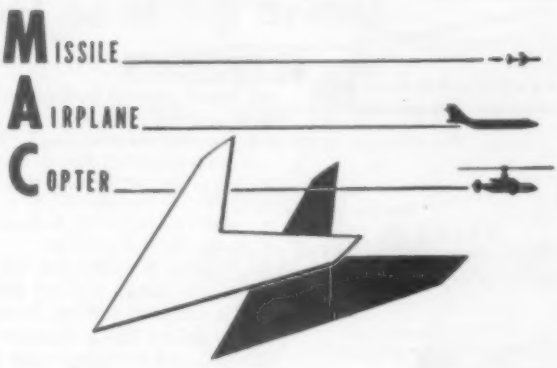

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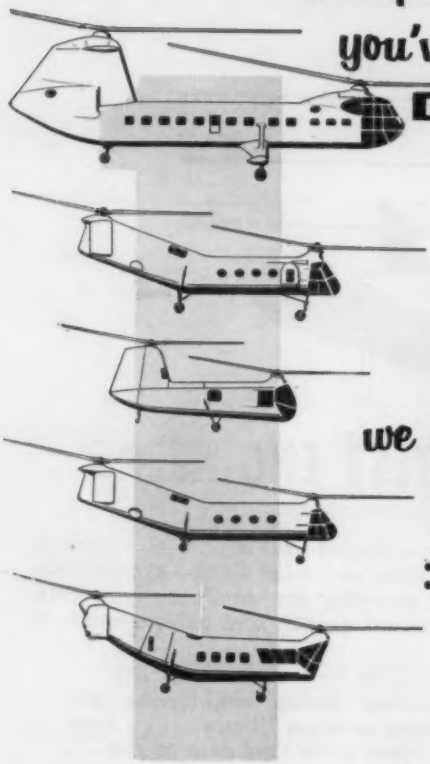

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Weigel said the only apparent disadvantage is the Viscount's high rate of fuel consumption and problems connected with it.

▶ **Fundamental Difference** – Raymond B. Maloy, chief of CAA's flight test branch, described the fundamental difference between a reciprocating-engine aircraft and a turboprop as the latter's "greater speed/height operating regime and the different thrust and drag characteristics of the power plant."

He said the differences cause associated problems. Maloy gave as examples cabin pressurization and powerplant controls.

". . . Many of these problems must be met by the formulation of appropriate policies governing their airworthiness aspects," he said.

CAB ORDERS

(Feb. 24-Mar. 2)

GRANTED:

Northwest Airlines a six-month exemption to allow free transportation to technical representatives of Lockheed Aircraft Corp. and Curtiss-Wright Corp. for purposes of in-flight observation.

City of Los Angeles leave to intervene in the Guatemala City-Los Angeles renewal case.

Southwest Airways permission to serve Burbank, Calif., through the Lockheed Air Terminal.

Frontier Airlines permission to serve Monte Vista, Colo. through the San Luis Valley Airport.

Delta Air Lines, Lake Central Airlines, North Central Airlines, Ozark Air Lines, United Air Lines, the Chicago Assn. of Commerce and Industry, the Greater Rockford Airport Authority and the Postmaster General leave to intervene in the helicopter air service certificate renewal case.

Mohawk Airlines permission to serve White Plains, N. Y. through Westchester County Airport.

Transocean Air Lines an exemption to operate one flight from Athens, Greece, to New York pursuant to a contract with the Intergovernmental Committee for European Migration. Action on three other Transocean exemption applications was deferred. Transocean is also permitted to lease a DC-4 from Iranian Airways Co. to operate the approved flight.

Piedmont Aviation permission to serve Parkersburg, West Va.-Marietta, Ohio, through Wood County Airport and Columbus, Ohio, through the Port of Columbus Airport.

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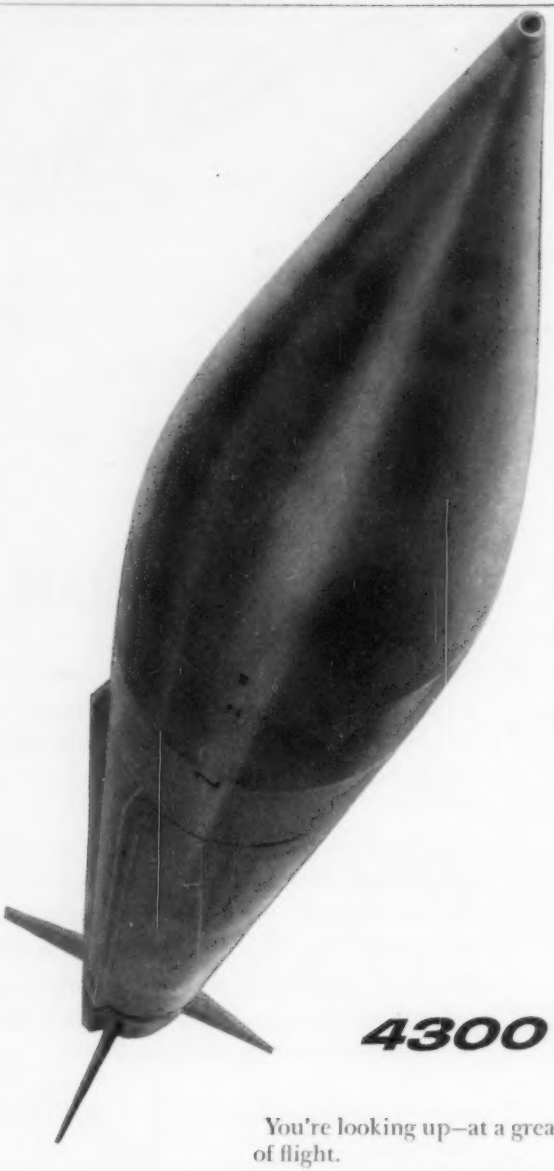

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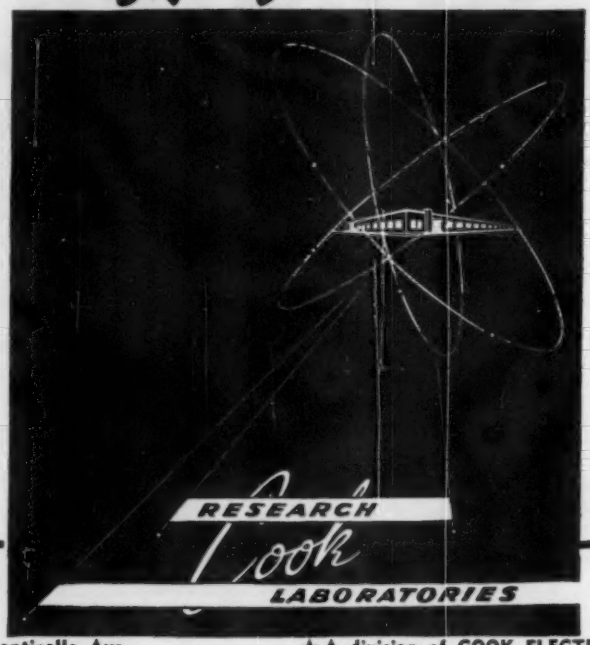

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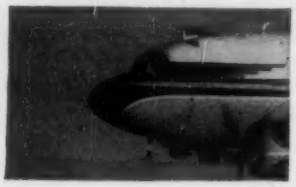

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EDITORIAL

Why We Underestimate Soviet Airpower

"You completely underestimate the Russian danger even in respect to technology. Russian work in aviation since 1946 has been completely consistent. Deviation occurs only in the political field. Many western visitors come to the conclusion that Russian aviation is just as poor as their technology in the civil sector. This is not true. The poor civil technology is actually a consequence of the Russian concentration on military technology.

An "intensification of the Russian technological advances is to be expected since they are getting more young technicians and scientists who have been well educated and trained . . ."

This solemn warning was received by AVIATION WEEK in a letter from an internationally known German aircraft designer who worked in Russia for more than five post war years. He now lives in the Western Zone of Germany.

This is the judgment of a man who is technically qualified to evaluate modern aeronautical research and development and who has been working in the midst of the Russian military aviation picture until only a few years ago.

It is a warning that should be carefully studied by the senators and representatives of the Armed Services and Appropriations Committees as they consider the Fiscal 1956 research and development budget for USAF, Navy and Army aviation.

Unless the United States enlarges its current slim margin of technological superiority over Russian airpower we will be doomed to defeat in another five to ten years. Without the foundation of an adequate research and development program backed by sufficient funds and a sense of national urgency our airpower technology cannot maintain the pace required for survival in the atomic "Age of Peril."

North American Shares Super Sabre Data

In the constant struggle necessary to protect its legitimate proprietary rights from encroachment by government officials and military brass with a socialistic economic outlook, the aircraft industry is often accused of taking a narrow selfish view of what should be broad problems of national welfare.

The recent policy of North American Aviation, Inc. on the F-100 Super Sabre accident investigation data offers specific evidence to refute this usually groundless charge. North American is a privately-owned corporation operating under the spur of the profit motive in a highly-competitive industry. In the course of investigating the F-100 accident that cost the life of its chief test pilot, George Welch, its engineers developed considerable data on the stability and control problems of supersonic aircraft in addition to that unearthed by USAF and National Advisory Committee for Aeronautics.

North American made this data available to other firms with which it is competing for USAF and Navy high speed fighter contracts. A detailed report on the F-100 data was prepared and submitted to other companies on request in addition to copies furnished both USAF and the Navy. The Navy's Bureau of Aeronautics, which has no direct responsibility for the F-100 program although it was encountering similar problems in its own highspeed fighters, was particularly grateful for the North American data and so stated to the company. Informal meetings also were held by North American engineers with Convair and Grumman to provide further details on the F-100 data.

This was a North American policy decision stimulated by its engineering vice-president, Ray Rice, and approved by top level management headed by James H. Kindelberger, board chairman, and Lee Atwood, president. In explanation of this policy to AVIATION WEEK, a North American spokesman wrote:

"The reasoning back of this action was simply that management felt that if we could save some other company or military test facility from having a fatal accident we should do everything possible to prevent that possibility.

"There is also the very broad thought that it was also of assistance to the defense program in the development of supersonic aircraft."

North American management's decision on this matter has won the admiration of both the military services and their competitors whom it helped on a problem of vital national welfare. It is irrefutable evidence that the aircraft industry can and does place national welfare ahead of personal profit when the occasion demands.

Pacific Wings Club

San Francisco is an area steadily growing in aviation importance. Its magnificent new airport is an international crossroads of the rising airline traffic to Asia and the Pacific islands. Both USAF and Navy aviation have important bases in the Bay area and the highspeed research laboratory of the National Advisory Committee for Aeronautics is only a few miles down the peninsula.

Indicative of San Francisco's growth as an aviation center is the establishment of the Pacific Wings Club. This group, now in its second year, aims to provide a focal point and facilities for aviation people in San Francisco and the Pacific islands similar to that afforded by the Wings Club in New York. It now has more than 200 members and club rooms in the Sheraton-Palace Hotel.

John Felton Turner of the California Aeronautics Commission is now serving as president. Among its members are such familiar aviation names as Terry Drinkwater, president of Western Airlines, Smith de France, head of NACA's Ames Laboratory, and Col. Clarence Young, vice president of Pan American World Airways.

The Pacific Wings Club is off to a good start. It can perform a pleasant and useful function. We wish it well.

—Robert B. Hotz

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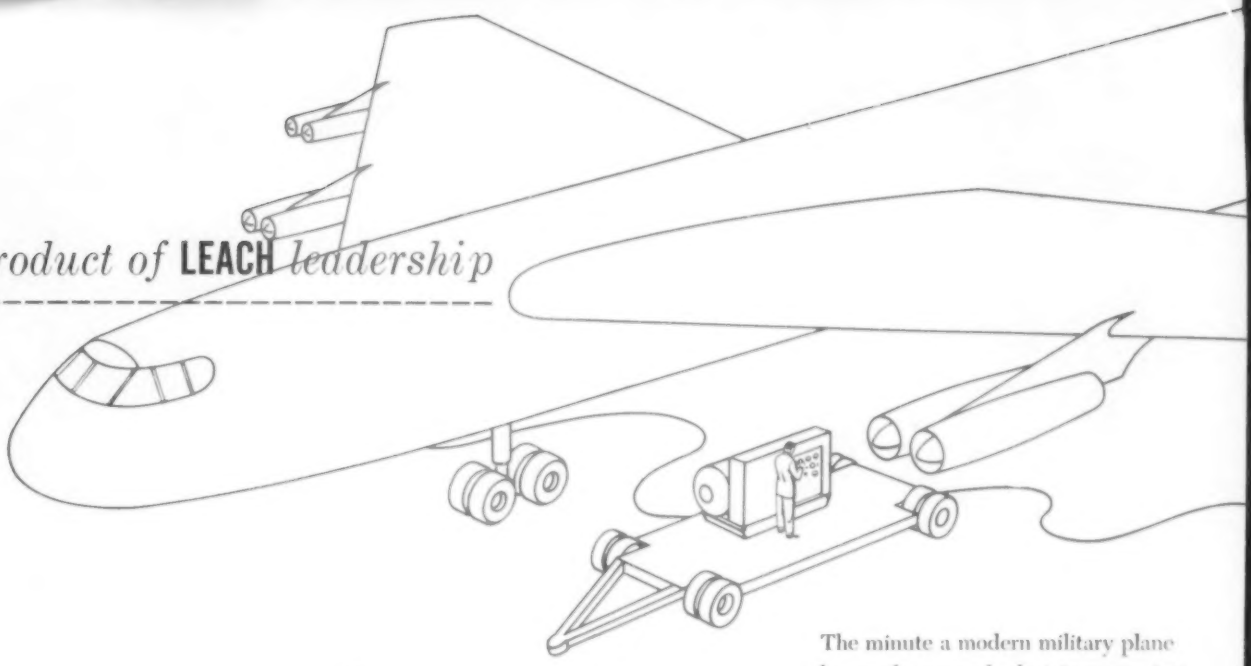

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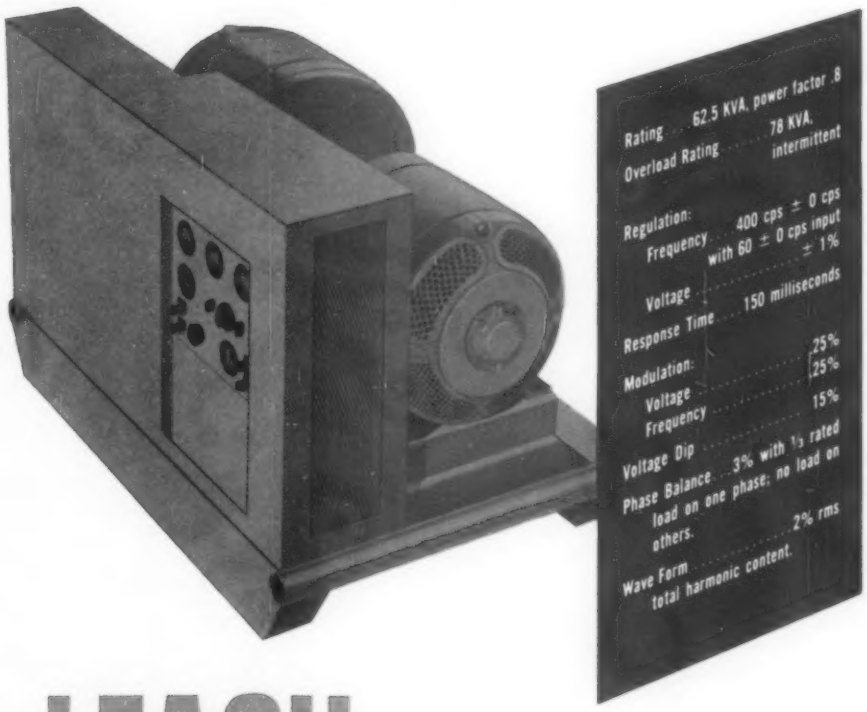

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Every B-47 "STRATOJET"

Uses this Amplifier and Power Supply Rack . . . another Servomechanisms' "building block" system

This sub-system is another outstanding example of Servomechanisms' packaged function philosophy.

Consider the seven SA104H Servo Amplifiers used in this system. Servomechanisms has designed and produced over 40,000 of these amplifiers. All are 100% electrically and mechanically interchangeable. They are a USAF standard – designated Type A-1 – and as such are "shelf items" in supply depots throughout the world.

As a USAF standard, these amplifiers are used in many other systems in almost every modern fighter aircraft.

This demonstrates how Servomechanisms' packaged electronic functions have helped standardize and simplify fire control equipment—and why designers and users of control equipment specify Servomechanisms, Inc., for economy and reliability.

The reliability of Servomechanisms' equipment is directly traceable to the ease of maintenance inherent in the "building block" philosophy.

SERVOmechaNISMS INC.
PACKAGED FUNCTIONAL COMPONENTS

EASTERN DIVISION . . . Post and Stewart Aves., Westbury, N. Y. WESTERN DIVISION . . . 316 Washington St., El Segundo, Calif.